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Published December 1 With Current News

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Wasting Our Power

WE HEAR discussion of the relative merits of coal, pulverized fuel and oil when used in central generating stations. This is all as it should be, but what are we as a nation really going to do about water powers? The cost and quality of coal, the obstacles in the way of getting adequate supplies, are very live questions for the central-station industry. But they are in a sense the problems of the ordinary day, like that of the commercial manager who wonders whether he will close his contract with Smith in the morning conference or that of the engineering operator who speculates on what particular system difficulty he will have to spend his Monday afternoon. The large problem for the electrical industry and for the nation is that of economical utilization of water power, of all fuel and power sources. We need to bring about the use of all the wasting water power that can be employed to the profit of industry and with economy of our irreplaceable fuel resources. Daily fuel and power are important, but in some dark future period those may be wanting if measures, stern and sweeping, are not taken to conserve nature's resources before the opportunity to do so is lost forever.

It is the electric age that we want. This has an appeal that is lacking in the slogans of "oil age" in the oil industry and "steel age" among the iron and steel people. Let us claim full advantage for the mystic wonders of our industry.

Rushing Convention Discussions

SOME conventions show signs of falling from the high position they once occupied as instruments of democracy. Instead of providing for a liberal interchange of ideas these meetings are often used to voice the opinions of the few while the views of the many are suppressed for lack of time or for other reasons. The members of an association who have ideas to present are entitled to equal opportunity to express those ideas. Furthermore, members who go to the expense of attending conventions for the purpose of hearing or taking part in the discussions, and who express such a desire, should have as much consideration in carrying out the program as is given to the authors of the papers presented. Presiding officers are too prone to allow an author unlimited time to read a long paper and then to limit or eliminate discussion. This detracts from the benefits of a convention to the individual and the industry. Members of committees have frequently expressed the opinion that much more benefit is secured from those gatherings than from the national convention of their association, where they have little or no opportunity to discuss the papers presented. But the opportunity to serve on committees is restricted to a very few. These conditions are usually worse in the larger organizations than in the smaller ones, but wherever they exist they can be corrected by giving due consideration to the interest and experience of those present at convention meetings who are familiar with the subjects presented, even to the extent of seeking them out and extending a personal invitation to take part in the discussions.

Pride in the job grows with knowledge of the logic of its performance. Therefore opportunity for the thorough analysis of departmental routine within the capacities of individuals should be provided even at the cost of considerable time and patient explanation.

Evolution of Alternating-Current Frequency

DURING the last thirty years some thirteen different commercial frequencies have been launched by the manufacturers of alternating-current machinery in the United States, ranging from 12.5 to 140 cycles per second. At the present time, however, the great majority of the electric systems in service employ either 60 cycles or 25 cycles per second.

The frequencies higher than 60 have nearly all disappeared, partly because of the relatively large number of poles required in the motors and generators and partly because of the relatively high reactance developed in coils and line conductors by these higher frequencies.

The frequencies lower than 25 have nearly all disappeared, because of the relatively heavy machinery they involved and also because of the objectionable flicker in arc and incandescent lamps due to such lower frequencies.

The principal reasons for introducing the 25-cycle frequency were that long transmission lines were supposed to operate better on lower frequencies and that many synchronous converters were easier to design at 25 than at 60 cycles per second. Recent experience has shown, however, that relatively very long alternating-current transmission lines can be operated advantageously on 60-cycle systems. Moreover, the difficulties in the design of 60-cycle synchronous converters have been smoothed over. Finally, in spite of many endeavors, the 25-cycle system is not entirely satisfactory for lighting service. There is, under some conditions, an objectionable luminous flicker. The question is, therefore, whether the 25-cycle system had not better disappear and leave the 60-cycle

system as the fittest to survive, for light and power distribution.

If all existing and new systems were to conform to the single frequency of 60 cycles per second, the facility of interconnection would be greatly increased. There can be little doubt that ultimately all the important electric systems in the country will be coupled and tied together into one universal network of power stations and consumption points. This procedure should be mutually advantageous to all interests concerned, even if the properties and property rights were entirely distinct.

A plea for unification of frequencies appears in a committee report on the distribution and use of electricity presented to the recent convention of the Association of Edison Illuminating Companies. It is pointed out that a large amount of capital is now invested in 25-cycle machinery and apparatus. If, however, all new machinery and replacements should be made in the 60-cycle frequency, it would only be a matter of one or two decades before the 25-cycle system would become obsolete and vanish. All that is necessary, therefore, in order to bring about the universality of 60-cycle machinery is to order 60-cycle apparatus exclusively in the future, and this procedure will insure the desired result without any burdensome investment or rejection.

A clear pathway for the consideration of suggestions for improvements from the man with the idea to an official competent to accept them or to give reasons for their declination should always obtain. Petty jealousies over matters of this kind have no place in right-spirited organizations.

Continuous Testing Records

THE paper by J. N. Strike which we publish this week shows an amplification of the project, occasionally carried out, of keeping a station under continuous test for the purpose of bringing it to the highest possible point of efficiency. The necessities of the economic situation, brought about by great increases in the cost of fuel, have given large importance to details of operation, and many companies are now keeping constant record of station performance for the purpose of checking loss before it has gone far. Numerous generating plants are equipped for a theoretically high thermodynamic efficiency, which, however, is seldom reached in every-day practice. Mr. Strike's paper deals with a recording and accounting system whereby not only the efficiencies but the operating costs as well are determined daily. Generally the performance data give a sufficient indication of the course of events without reducing them at once directly to costs, yet if the costs can be systematically and quickly obtained they add useful information immediately available.

In the practice of the Toledo plant to which Mr. Strike's data refer, it has been found possible to keep up the daily determination of costs and efficiencies by the labor of only one extra clerk in the bookkeeping department, and an equal amount of labor would probably obtain the data in a much larger plant if applied in the same systematic way. A series of eleven record sheets are used, on which are entered all the necessary data. Seven of these are detail sheets filled out by the operators each day, recording every item of supply and every detail of operation that can bear on efficiency. These individual data are finally checked and entered on a summary sheet which carries the complete performance of the plant and the percentage of efficiency for the current day and month, and for the corresponding period a year previously, including a complete heat balance of the station. Corresponding to this is a daily cost sheet including the total input in money and output in kilowatt-hours, together with a minute record of the stock. The system has been in successful use for more than a year, and the high operating efficiency of the plant indicates that it performs valuable service. Just how far any given station will find it advantageous to follow out such minute details is, of course, somewhat uncertain, but the remarkable feature of the plan is that it is able to yield such complete information without a prohibitive amount of labor.

Interconnection as a war measure would have been far advanced by the fall of 1919 *if the armistice had not been signed. Though war is no longer the motive in such development, the economic reasons why it should continue are unanswerable.*

Passing of the Engine-Driven Mill

WHEN one remembers the hesitancy of textile-mill operators in taking up motor drive, the change that has come over the situation is most impressive. One after another big mills and little are coming to realize the great practical advantages of electric operation, particularly when subdivided as far as conditions permit. An admirable example of changing practice in this respect will be found in a brief article by H. C. N. Ripley on the new equipment of a group of mills in Chelsea, Mass. The original equipment, now a relic of days gone by, was a single-clyinder Corliss engine belted to a line shaft running through three mills and carried on wooden trusses between them. This veteran is now in the discard, one of the old mills is being torn down, and the other two, themselves on the way to replacement, are driven each by a single three-phase motor. Ten years ago the first motor-driven addition was built, representing a stage of evolution not unfamiliar to many engineers in which a single motor operated the machinery by shafting and belting.

The new mill recently completed belongs to the present rather than the past. Each of the fifty-two heavy looms in the weave shed is driven by an individual motor, and throughout the rest of the mill separate motor drive is likewise in use. Only in the machine shop, owing to the cost of applying motors to all the existing machines, was the belt-and-shaft system retained. The lighting of the new mill is as up-to-date as the motor equipment, being carried out by gas-filled tungsten-filament lamps in dome reflectors, giving an illumination of approximately 5 foot-candles throughout the working part of the building. This is a long step in advance of old-time lighting, and even of the lighting conventionally required for textile mills, and its value will undoubtedly be reflected in better output. Energy for the whole group of mills is purchased from the Boston Edison company and distributed at 220 volts, three-phase, for motors and at 110 volts to 210 volts, single-phase, for lighting. Mr.

Ripley's description conveys a very forcible idea of the rapid changes for the better which have come about in the power equipment of textile mills.

Despise not the saving thrift of "home-made" plant "kinks," which have their own place in the industry. Sound mechanical construction, however, should always be combined with clever electrical designs in rigs of this sort; else poor service, and perhaps fire or accident hazards, may be created which will wipe out in a few moments the differential between the construction costs of "A-1" and indifferent-grade work.

W. D. Weaver, the Scholar, Engineer and Editor

IN THE early hours of Sunday morning, Nov. 2, William Dixon Weaver died at Charlottesville, Va. Mr. Weaver's name had been indelibly impressed on the science and the art of electrical engineering for a quarter of a century. His was a remarkable personality. No one who remembers that finely chiseled face, the clean, serious features, in later life crowned with silver hair, can forget the impression his personality made on all who met him.

"The good men do is oft interred with their bones." No one was ever more willing for this to happen in his own case than Mr. Weaver. He cared for no praise or public recognition. Wherever his strong personality could promote right, truth, justice and the finer and nobler aims of human society, no more relentless fighter could be conceived than he. Carefully and diplomatically sifting the material necessary for a clear understanding of an issue, he grasped the essential points and proceeded with tact and vigor to aid the accomplishment of just and noble ends. Mr. Weaver belonged to no narrow sect of engineers or editors. The advantages which he gained as a young naval officer in cruising all over the world were used to broaden his vision. They prevented him from becoming infected with that narrow provincialism so characteristic of men who year in and year out pursue the every-day tasks of their lives in surroundings narrow and ever narrowing more. A scholar by nature, his broad and careful reading had acquainted him with the history of the science of electricity, and his great fondness for political history had added to his vision a clearness sorely and sadly lacking in this generation. Scholar, patriot, journalist and gentleman have rarely been combined so finely in one personality. Fearlessness marked his every act. He was never careless in the expression of his views, yet, after a careful study of conditions, it mattered little who his opponents were. The columns of the paper over which he presided as editor were always open to those who wished to express opinions against prevailing prejudices and prevailing force.

It is difficult to describe and to appraise the work of Mr. Weaver. As editor of the ELECTRICAL WORLD his vision and his influence placed before the American electrical engineers the very best work in theory and practice both here and abroad, and through this agency he contributed more to the development of electrical engineering than we are able to estimate. His real influence in the development of the electrical industry of America of the past twenty-five years will never be fully known. The aid and encouragement Mr. Weaver extended to the authors of the most important papers and books on electrical engineering subjects published in America during this period constituted one of the great factors in the progress of our art.

Honor came to Mr. Weaver from his Alma Mater, which not long before his death conferred upon him the degree of doctor of laws. It came to him also from the American Institute of Electrical Engineers, which owes both its home and its library in no insignificant degree to his efforts. The tribute of the Institute took the form of the bronze tablet shown on page 861, representing his fine features in bas relief. He coveted nothing of this sort and, gently but firmly, almost repulsed any attempt at giving him recognition. He spent the latter years of his life virtually in retirement, although he remained deeply interested in the events of the day and in the development of the electrical field in America. We do honor to his memory, holding high the principles which his whole life embodied and which he carried out to the glory of journalism and to the advancement of truth in its highest forms.

Intensive development of new business along existing feeders deserves vigorous cultivation. Overhead charges are unlikely to fall materially for many months, if not for some years. There is a decided tendency among central-station solicitors to go after patronage involving line extensions because it is often easier to obtain than increased business among settled customers. The saturation point is still far from attainment even in installations within a half mile of the generating plant or substation.

The Electric Furnace in Steel Making

EVERY steel maker will grant that steel of more uniform and superior quality can be produced in an electric furnace than by means of the Bessemer or open-hearth process. He may also be willing to concede the ease of operation and the saving in space. It is the price per ton that he will probably argue about, as based upon power consumption and the cost of power. It is here that one or two advantages of the electric furnace need be pointed out. With a non-electrical process, the per cent of rejection in billets is as high as 20; on strict governmental specification, up to 40 per cent of the material is known to be rejected for physical defects. Of course, this does not mean that this material is simply dumped into a river with the slag; nevertheless, it must be cut again by shears, carried to a charging machine, put into a furnace, melted, made into ingots, and must go through the blooming mill. Thus between one-fifth and two-thirds of the total material is circulating uselessly as a burden between the scrap heap and the furnace, causing an unnecessary expense and cutting down production. It is said on good authority that with the electric furnace rejection can be easily reduced to 10 per cent, with the resultant saving in the cost of the output. Furthermore, a poorer and cheaper material can be used which it would be impossible to refine in any other furnace.

Another source of waste is in the so-called "stickers"; that is, ingots which cannot be pushed out of molds. They also go into the scrap heap, have to be broken up and remelted. Stickers are due to a wrong temperature of pouring, unavoidable when a large charge is first poured from a furnace into a big ladle and then distributed into the molds.

WILLIAM D. WEAVER DIES IN HIS VIRGINIA HOME

Former Editor of the "Electrical World" Lived an Active Life and Accomplished Much for Electrical Engineering Profession

NEWS of the sudden and quite unexpected death of William Dixon Weaver, former editor of the ELECTRICAL WORLD, was received in New York on Nov. 2 and evoked expressions of the most sincere regret from all who had known him. To the older subscribers of the ELECTRICAL WORLD, whether they were acquaintances of his or not, his passing will come as a personal loss, so closely was he for years identified with its contents and its policy. Mr. Weaver died at his home in Charlottesville, Va., in the night of Nov. 1-2, death coming apparently from heart failure while he slept. He had spent the day, apparently in the best of health, with Dr. Carl Hering of Philadelphia, who was visiting him for the week-end. In the evening they were at the office of John L. Livers, vice-president and general manager of the Charlottesville & Albemarle Railway.

Mr. Weaver's work as editor of the ELECTRICAL WORLD left an impress which has never departed from the character of its pages. His own estimate of what he sought to build into the paper was expressed in a signed editorial at the time of his retirement from its active direction, May 4, 1912. The cause for which the ELECTRICAL WORLD stands he described as "full and uncompromisingly independent journalistic representation of the great field of electrical activity. The ELECTRICAL WORLD," he continued, "is an institution dependent not so much on one man's guidance as upon aims, policies and ideals."

These words are reprinted because they reveal the basis of his work. He developed an organization trained to regard the ELECTRICAL WORLD as an institution with an earnest mission and to follow wholesome aims, policies and ideals. Most of his work found its real expression through the columns of the paper, but he had time for other activities which also touched intimately and helped the growth of the industry. In all of these he sought with persistent energy to attain the end itself, not credit for himself. It was characteristic of him to be content to start a creative movement and then to stand aside, letting its own momentum carry it forward to deserved success. Mr. Weaver's contact with men was marked by the simplicity and unostentation which endeared him to many who knew him well. He resolutely refrained from claiming the honors which might easily have multiplied for one who inspired and did so much in the world. He preferred the seclusion of his work, he desired the perfection of that over which he labored, rather than conspicuous recognition for himself.

To younger men who knew him intimately Mr. Weaver was a loyal friend and counselor. He was never too busy to give time to them, never too much occupied with important affairs or people to notice them. And his range of friendships extended far, both in this country and abroad, among many kinds of people.

Mr. Weaver's interests led him to give much of his leisure time to bibliography and the collection of publications on the French Revolution. This collection is now one of the largest on the subject in existence.

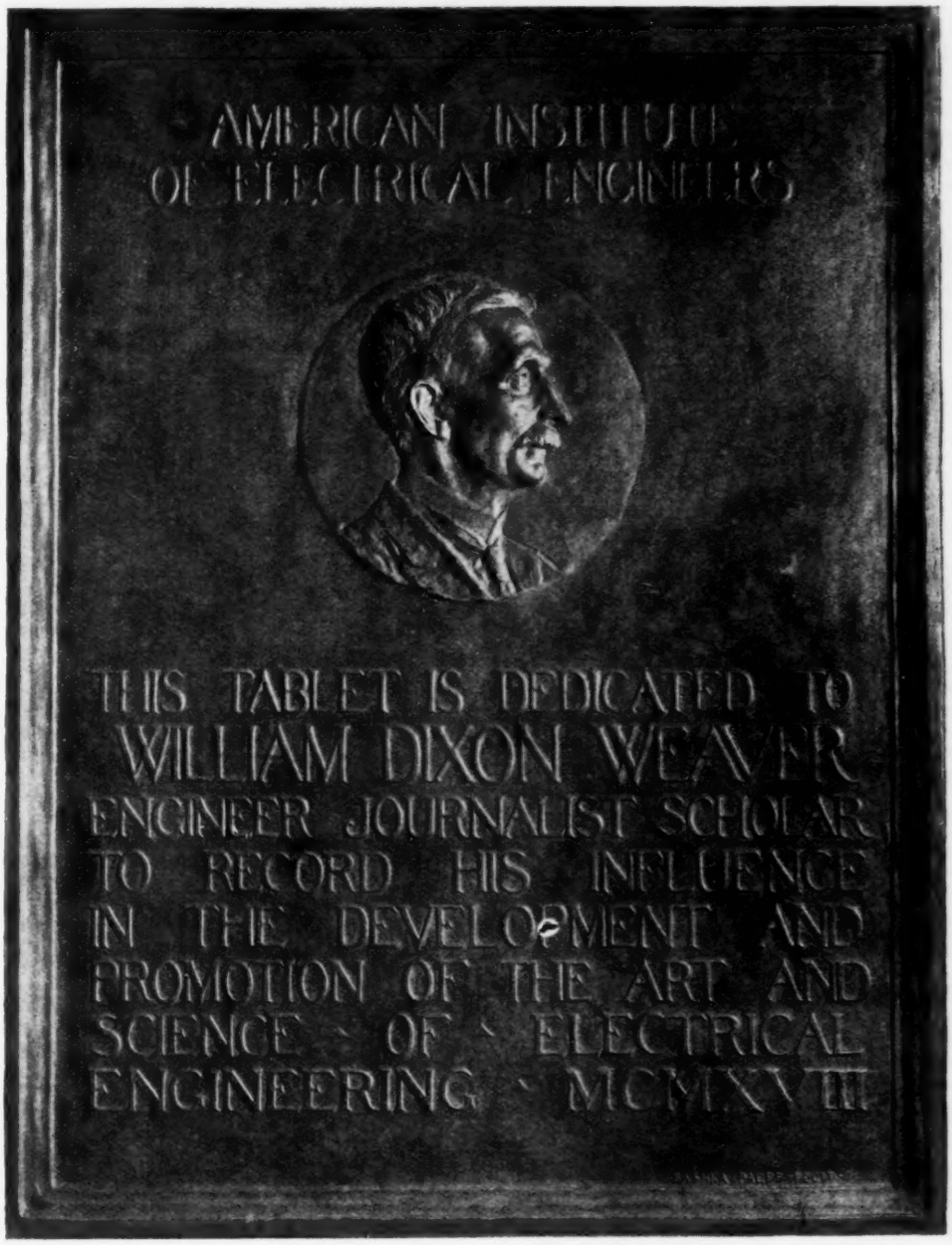
Born in Greensburg, Pa., Aug. 30, 1857, Mr. Weaver received his early education at Kentucky University, which gave him recently the honorary degree of LL. D. When nineteen years old he entered the United States Naval Academy and was graduated in the class of 1880 as cadet engineer. He served in the navy for twelve years, except for a year's leave of absence in 1884. During that year he studied electricity and conducted some investigations in the electrical laboratory of the Sorbonne, Paris, and the School of Electrical Engineering in London. In 1883 he accompanied the first Greely Relief Expedition on the U. S. S. Yantic. As assistant engineer of the navy, Mr. Weaver made a cruise of the world on the U. S. S. Omaha and spent two years in the waters around China, Japan and Korea. While he was stationed at the Brooklyn Navy Yard he designed an electrical recorder which was largely used in speed trials and at the launching of naval vessels and also an apparatus with electrical attachments for the calibration of steam-engine indicators.

After some experience in the manufacture of electrical apparatus, with the firm of E. G. Bernard, Troy, N. Y., Mr. Weaver decided to carry out his desire to do editorial work. He was made editor of the ELECTRICAL WORLD in 1893 as then published by the W. J. Johnston Company. Three years later he became associated with James H. McGraw in the founding of the *American Electrician* and was its first editor.

BECOMES EDITOR OF THE ELECTRICAL WORLD

In 1899 the ELECTRICAL WORLD and the *Electrical Engineer* were purchased and consolidated by Mr. McGraw, and Mr. Weaver and T. C. Martin became editors of the combined paper. After the absorption of the *American Electrician* the title reverted to the ELECTRICAL WORLD, and this title has since been retained. With the exception of a leave of absence during the Spanish-American War, Mr. Weaver continued as editor until May 1912. In the Spanish-American War he served as volunteer chief engineer on the U. S. S. Glacier.

Intensely interested in the organization of the electrical engineering profession and in the societies through which it was perfected, Mr. Weaver still directed his efforts so modestly that relatively few people knew of his work. For instance, it was Mr. Weaver who presented in 1895 to Andrew Carnegie an outline for a home for the national engineering societies which the ironmaster's later generosity made a reality. Large credit is due to him for the plan of organization, management and development of the Illuminating Engineering Society. He was one of the founders of that society and also of the American Electrochemical Society. He served for six years as manager of the American Institute of Electrical Engineers and also was an official of the Illuminating Engineering Society and the American Electrochemical Society. He was active in the development of the electrical engineering library which is part of the facilities of the Engineering Societies Library. In 1904 he was treasurer and business manager of the International Electrical Congress. His long labors led to the formation of the Commission on Resuscitation from Electric Shock, which has been of great value to the world in life-saving. This commission, as is well known, is composed of representatives of the American Institute of Electrical Engineers, the American Medical Association and the National Electric Light Association. It should be said of Mr. Weaver's work that wherever his heart and interest were enlisted he gave liberally and effectively out of his large abilities to contribute to success.



As an engineer William Dixon Weaver made an indelible impression on the electrical development of his time. Leaders in the electrical industry both at home and abroad recognized his unusual gifts and were glad to work with him as a colleague. As an editor Mr. Weaver achieved and scrupulously maintained the highest standards known in technical journalism. To broad knowledge he added unwearied industry. To wide acquaintance with the men, events and traditions of the electrical industry he brought inflexible courage and will to publish and to say what he believed to be right regardless of all considerations but the truth. As a man he held the love and esteem of all who knew him. With a modesty and gentleness so pronounced that it may be called invincible, he had a virility of will and independence of thought that made him always a master and leader.

James H. McGraw

Going to Charlottesville after his retirement from active direction of the ELECTRICAL WORLD in 1912, Mr. Weaver up to the time of his death took a public-spirited part in the affairs of that Southern college city. It was characteristic of him that he helped to found a national bank there, believing that this was needed to meet the requirements of the community. He was deeply interested in the development of park centers, and in various other ways his time and restless energy were given for the betterment of the community.

The Weaver memorial tablet, which is shown on the preceding page, was erected in the Engineering Societies Building in acknowledgment of the services of Mr. Weaver to the American Institute of Electrical Engineers and was unveiled on May 16 of the present year. On receiving the news of his death the Institute passed the following resolution:

RESOLUTION OF THE INSTITUTE ON MR. WEAVER

WHEREAS on Nov. 1, 1919, the engineering profession sustained a great loss in the death of William Dixon Weaver, engineer, journalist and patriot; and

WHEREAS Mr. Weaver was an honored and helpful member of the American Institute of Electrical Engineers for more than thirty years and was transferred to its highest grade of membership, that of fellow, in 1913; served with distinction upon numerous important committees and as a member of its governing body for six years, was largely instrumental in securing a permanent home for the engineering societies, aided effectively in building up the Institute library and rendering it serviceable to the membership, and was ever ready to lend assistance and aid to deserving causes and men; be it

RESOLVED: That the board of directors of the Institute hereby places on record this expression of its sorrow and its appreciation of William Dixon Weaver's long-continued, generous and active interest in the Institute, his sincere sympathy with its objects and his earnest devotion to the highest ideals in the growing field of electrical science; and further be it

RESOLVED: That these resolutions be spread upon the minutes of this meeting, that they be printed in the *Proceedings*, and that a copy be sent to Mrs. Weaver.

Tributes to William Dixon Weaver and His Work from Some of His Personal Friends

W. H. Onken, Jr., editor of the ELECTRICAL WORLD, who was a coworker with Mr. Weaver for almost twenty years, was on the Pacific Coast at the time of the latter's death. Because of his long association with the ELECTRICAL WORLD and Mr. Weaver and his intimate knowledge of the early conditions surrounding technical journalism, he can speak advisedly of Mr. Weaver's contribution to the profession and to technical journalism. Mr. Onken's tribute follows:

Mr. Weaver's death comes as a shock. Those who knew him best—that is, those who labored beside him many years and had ample opportunity to observe his every act, word and deed—can bear tribute to his worth. Reticent to a fault, he never sought to bask in the sunlight of publicity or strove for personal glorification or reward. Thus Mr. Weaver was known but slightly to the outside world, but he worked long and assiduously for the profession of electrical engineering and for upright, fearless journalism. The trade press of the early days was lacking in vision. The spirit which animated it was grossly commercial, mean and narrow. It would be a profanation to mention the technical journalisn of to-day in the same breath with it. One has but to compare the two to note the vast improvement which has taken place. With this uplift in trade and technical journalism Mr. Weaver and Mr. McGraw, the publisher, had much to do. Electrical engineering was then just beginning to take root in this country as a profession, and Mr. Weaver as a careful husbandman watered and furrowed and watched it grow into a great and fruitful tree.

I doubt whether the bronze tablet on the walls of the rooms of the American Institute of Electrical Engineers in New York acknowledging the debt of the electrical fraternity to Mr. Weaver brought more joy to him than it did to his friends. Certainly the tribute was well deserved, and it must have been a comfort for him to know that electrical engineers are not ungrateful, that the inspiration and encouragement which he gave them were not in vain, and that the seed sown many years ago brought forth a thousandfold. His influence was ennobling alike to the profession and to his colleagues.

From B. A. Behrend, Boston, Mass.:

Perhaps few realize the greatness of Mr. Weaver and what he has done, not soley for the ELECTRICAL WORLD, but for the electrical industry of America and for the dignity of our profession as well as for the advancement of the highest type of scientific engineering. With Mr. Weaver we have lost a figure and character of a type unfortunately rarely met either in our social or our engineering life, and I regret to say well-nigh an extinct order. It seems, in a sense, almost like a fitting and extraordinary tribute to him that at his death the great paper which he dominated for so many years should temporarily have ceased appearing. It seems almost as if the gods themselves desired that his publication should show by its transient disappearance its grief at the death of him whom we mourn and whom nothing can every replace.

From Thomas Commerford Martin, New York City:

Many distinguished men have entered the American electrical field by way of the navy,—Duncan, Emmet, Shallenberger, Dana Greene, Roller, Mitchell, Sprague—but none more distinctively pre-eminent in his own field than Mr. Weaver. Whatever else he might be, and he was not less versatile than profound, Mr. Weaver was a masterly editor. At least two great electrical journals bore the imprint of his genius and leadership. Of one of those he might be called the founder, while to the evolution of the other he brought constructive talent of a high order. He had the news sense, quick appreciation of the value and importance of a topic, a remarkable divination of the real, true and eternal, little patience with pretence or self-seeking, a warm human sympathy, and a glorious power of hating strongly. If he though he was right, he would readily make an enemy; but how his friends loved him! With great capacity for team work, he was always ready to fight a "lone hand" if the cause appealed to him.

Making no claim to brilliant journalism and rather slow in freeing his system of expressions and ideas, he was sure of the mark when at last he "O. K.'ed" the final proof, and unfailingly the stuff was all worth the while. He was the permanent historian rather than the temporary chronicler, as evidenced by the splendid research work done on the classic descriptive catalog of the Wheeler-Latimer Clark library. He never wrote for the "weary business man" or anybody else tired. Alert of intellect, he required instant mental reactions in those he addressed. Likewise did he emphasize character, aiming at the highest professional ideals. A warm admirer of eloquence, he shunned the platform for himself as he would the plague. Of the two, he preferred the latter.

Weaver sought no honors. He declined membership on the Naval Consulting Board as he did the presidency of the American Institute of Electrical Engineers, but in neither case did this in any respect or degree limit the service rendered. He simply did not want any distinction, even as an implied reward, for duty done gladly to his country, his profession and any worthy cause. He carried such altruism to its utmost. He was almost angrily repellent to the insistence that such recognition is only an essential part of human affairs, but, conversely, rejoiced ever to see some friend receive the honor he turned way from himself.

From Dr. A. E. Kennelly, Harvard University, Cambridge, Mass.:

William Dixion Weaver was a man of very charming character and of marked abilities. He was the soul of integrity. His confiidence in the loyalty of his friends was as great as his friends' confidence in him. He had a rare sympathy toward young men, and befriended them in many ways. His smile was a delight to the eye—winsome yet restrained.

Intellectually he was a combination of the engineer and the man of letters. In the estimation of human accomplishment his mind constantly reverted to the work of the engineer. As a journalist and editor for many years in the field of electrical engineering he had a marvelous talent for discerning literary abilities and powers of literary exposition. He seemed to know not only which men had contributed notably to the electrical engineering literature of the past but also who were the men

capable of making notable contributions in the present. He could appraise the scientific and literary qualities of engineering books or papers with marvelous skill. The combined engineering library in the Engineering Societies Building in New York City is largely due to his enterprise and labor.

I had the privilege of knowing him well for many years. I never heard him utter an unkind word or an ignoble sentiment. In affectionate remembrance I shall always remain his admirer and debtor for the happiness of having known him.

From Dr. Louis Bell, Boston, Mass.:

The sad news of Mr. Weaver's death brings to me a sense of deep personal bereavement, as well as the sorrow that must always follow the loss of a fine and brilliant spirit to the world. I had know Mr. Weaver for nearly thirty years, and each of them had given to me a keener appreciation of his ability and character. For absolute loyalty to truth and righteousness it would be hard to name his equal. If there was one thing on earth that he cordially destested, it was a lie or a humbug, and all through his long journalistic career he stood stanchly for truth and integrity and fairness, unwavering and uncompromising. This ideal he instilled into all who worked with him, and his example will live long in their hearts. He had a peculiarly judicial and penetrating mind with an untiring capacity for labor that gave it added powers. Those who worked with him on committees came quickly to appreciate the incisive quality of his understanding and the calm judgment with which he backed it up. The history of the American Institute of Electrical Engineers in particular bears witness to his ceaseless devotion. The profession was enriched by his character and example, and those of us who enjoyed the privilege of his friendship will cherish his memory so long as we may live.

From Dr. Carl Hering, Philadelphia:

Owing to his extreme modesty and his tendency to shrink from personal publicity, only the more intimate friends and associates of W. D. Weaver could fully appreciate that noblest characteristic of his personality—always being ready and willing to go to any amount of trouble for the benefit of others or for the general good. A question to him always brought an answer, showing a most careful, intelligent, unbiased and thorough study. The pleasure of having benefited some one else or some institution was his only, and always adequate, compensation. It may well be said of him that he was altruistic to a fault, for in his generosity in working indefatigably for the benefit of others he often neglected his own personal interests and, most important of all, his health, which in his later years suffered because he was always too busy, though nominally he had retired. Voluntary work was a pleasure to him. Instead of selling valuable collections of books, he would present them to some carefully selected institution because he was then more sure they would be of greater benefit to others.

He was most intent upon correcting historical records, especially those pertaining to the early history of electrical development, and at the time of his sudden death he was finishing the early history of the Electrical World and of the ante-Morse telegraph. Concerning the latter some incorrect information had been published, which troubled his spirit of fairness.

The mind in his weak body was a veritable encyclopedia of reliable information; his friendship was always sincere; his sense of honor was unimpeachable; his congenial presence was always inspiring; in his work he was indefatigable; in his altruism he was a rare model for others to follow; in his family life he was a devoted husband and father.

From Prof. Elihu Thomson, East Lynn, Mass.:

The news of the loss of my dear friend W. D. Weaver gives rise to a deep sense of sorrow, for I always held him in most affectionate regard. His fine personality and unwavering fidelity to duty need no emphasis for those who were so fortunate as to know him well. We of the older generation are able to testify to the invaluable service to electrical engineering which he, in various capacities, was always ready to give. Foremost among such services was his editorship of the Electrical World. To all work that he undertook or which fell to him to do he gave unsparingly of his best judgment and great ability, calmly, modestly, without the least trace of ostentation.

He was absolutely fair and true in his professional and personal relations. There was about him a quiet dignity and considerateness that marked him as the true gentleman. His ideals were always of the best and highest. The world loses much when such men as he pass out of its activities.

From F. W. Roller, Roller-Smith Company, New York City:

The electrical profession does not stand alone in feeling Mr. Weaver's loss. He was more multisided than many of his associates, even close ones, sometimes sensed. My own contact with him, commencing in the nineties, happens to have emphasized this phase. In our work together on the library committee of the Institute, back in the days when a few rooms in an office building on Cortlandt Street served to house its entire literary treasure, he was indefatigable in locating and securing volumes and collections which have since become priceless. In that line alone his activities extended into every corner of Europe. He retained, too, close touch with his former navy associates who were constantly turning to him for the benefit of his wide knowledge of advanced progress in engineering in its broader sense. Simultaneously, he had thrown himself heart and soul into the development of the *American Electrician* and the Electrical World, of which he was editor and vital propulsive force. And in his leisure moments he pursued his studies of French history, in which he even in those days had attained eminence as an authority to whom French savants themselves were ready to defer.

From Ralph W. Pope, Elizabeth, N. J.:

I first met Mr. Weaver in 1885 at the office of the Electrical World, 11 Wall Street, and soon learned his high ideals in electrical engineering and journalism. Two years later, after returning from China, he joined the American Institute of Electrical Engineers, and our relations became closer as he interested himself in the work. We met in Paris in 1900 at the joint convention of the Institute and the British Institution of Electrical Engineers. A little later Dr. Wheeler's purchase of the Latimer Clark library brought us still closer together, for he was enthusiastically devoted to the upbuilding of a great engineering library and lived to see his early efforts carried on to the fullest fruition. I unite with the entire profession in regretting that he was not spared to continue his work for the benefit of ourselves and the generations to follow.

From Frank J. Sprague, New York City:

Mr. Weaver's character and work are too well known to need detailed comment by me. A man of strong individuality, engaging personality and highest character, he brought to his editorial work an unusual equipment. His success was enhanced by his keen journalistic instinct, his painstaking ambition to be at all times thorough in his work and his considerate open-mindedness, or what might be termed his judicial character. His retirement from active editorial work was a distinct loss to journalism, and his death a greater one to a host of friends in the electrical profession, of which he was an ornament.

From J. M. Wakeman, general manager Society for Electrical Development, New York City:

Mr. Weaver's broad-minded outlook, his wonderful fund of general knowledge, his whole-hearted friendliness, his interest in every one deserving such interest, his devotion to his family, his work and his friends, endeared him to every one fortunate enough to know him and be associated with him. I esteem it a privilege to have worked so closely with Mr. Weaver for so many years on the Electrical World and to have been able to maintain our friendship to the end.

From Charles W. Price, *Electrical Review*, New York:

I considered Mr. Weaver one of the clearest thinkers and ablest writers in the technical profession, standing in the front rank with probably a half dozen others who wrote and spoke on electrical matters. His editorial judgment and policies were always sound and progressive, and in the many interviews and occasional dinners we enjoyed together I always left him with increased esteem and the feeling of having been enlightened.

From George H. Guy, New York Electrical Society, New York City:

William Dixon Weaver will always be a unique memory. He was the surest refuge in time of trouble, and when conditions were baffling and prospects were ominous his wise counsel and his active help have over and over again solved the difficulties of a crucial situation. In fact, his services to the society were incalculable. It will interest the membership and his friends to know that at the moment of his death there was before the officers of the society a proposal to make him an honorary member which would have been submitted at the next meeting of the society. This is a distinction that is rarely conferred.

Keeping Records That Aid Load Dispatching

How the System Operator of the Philadelphia Electric Company Conducts His Duties—Nature of the Records Which Are Used to Facilitate Work—Training Required for the Important Duties of Load Dispatcher

BY FRANK GILLOOLY

LOAD dispatchers, or system operators, are coming to be recognized by central stations as having more power to improve or reduce the economy and reliability of plant operation than probably any other individuals. In view of this fact such companies are providing their system operators with the assistants, record-keeping facilities, etc., necessary to carry on their work to the best advantage and are no longer looking on this occupation as a clerical job but as real engineering supervision of operation. The dispatcher must have had operating experience in a plant and in addition must be an analyst of data and a student of power-plant economy. Whereas formerly many companies looked on dispatchers practically as telephone operators who recorded reports and transferred orders, using a certain amount of judgment, they are now seeing them in the proper light as guardians of uninterrupted service, protectors of employees from electrical hazards, advisers regarding emergency operation, detectors of causes of uneconomical operation and suggesters of better methods.

In the operation of the Philadelphia Electric Company system the load dispatcher forecasts the demand to be met, schedules it on the generating stations, ascertains that each station will have the boiler, generator and cable capacity to carry its load, and that there will be reserve equipment on the system sufficient to compensate for the loss of the largest unit running. Besides, he directs all switching and maintains the necessary apparatus in service throughout the system to carry the load. In addition, he issues the permits for taking apparatus out of service and is responsible for all blocking and for the testing of new and repaired equipment.

As brought out in an article beginning on page 347 of the Aug. 16 issue of the ELECTRICAL WORLD, a load-dispatching system was established in this company in 1910. The duties of the position so increased that five years later the dispatcher was moved from the generating station and given an office of his own in the company's main office building. To-day the system contains 3650 miles (5875 km.) of lines, and the dispatcher handles four kinds of transmission and five kinds of distribution. There are a total of ten generating stations, twenty-eight company substations and forty-five industrial substations.

To effect the highest operating efficiency the load dispatcher must know the actual load carried and the possible demand on every part of the system, the amount of which depends upon the fitness of the equipment, the season and the weather and the activities of the territory served. If there is insufficient equipment available, or if that available is not in the best operating condition, the full load cannot be carried. The change of seasons brings a change in the amount of load and a shifting of the peak-load periods. On extremely cold winter days and on stormy days in any season some classes of load are decreased but the total load is increased, while on extremely hot summer days the load is decreased. No two holidays have exactly the same effect on the load, nor does any one holiday affect the load the same at all parts of the system.

The log book is one of the accessories of a load-dispatching office dating back to the institution of this department and is one of the most important. From the logs for previous years the dispatcher can obtain the load figures for any day in each of those years, and from them he can compute the demand to be met on that day. His next record is the substation log for a complete year, from which he can calculate the demand on every part of the system. His third record is his file of yearly load-curve cards, which show the weekly peaks of each class of load and the total load on the system, on each generating station, substation and industrial substation.

How the Log Sheets Are Kept

Two main classes of load are carried—25-cycle railway load and 60-cycle power and lighting load. The system log sheet (Fig. 1) gives these two divisions by stations in hourly or half-hourly readings, the latter being taken at the three times of day when the load changes are greatest. On this sheet are recorded the highest 25-cycle, 60-cycle and total load swings occurring in the morning, the afternoon and the evening respectively, with the loads of the largest high-tension customers at those times and their peaks for the day. A continuous record of the weather for the twenty-four hours is kept, also the peak load for the day on each generating station and the time on and off of street lighting. A space is provided for the dispatcher's memorandum of the maximum capacity, or load limit, of each generating station.

The auxiliary log sheet is a two-column, ruled sheet of the same size, containing the diary of operation. The sheets are given page numbers to correspond with the day of the year, with letter suffixes to keep the sheets for each day in sequence.

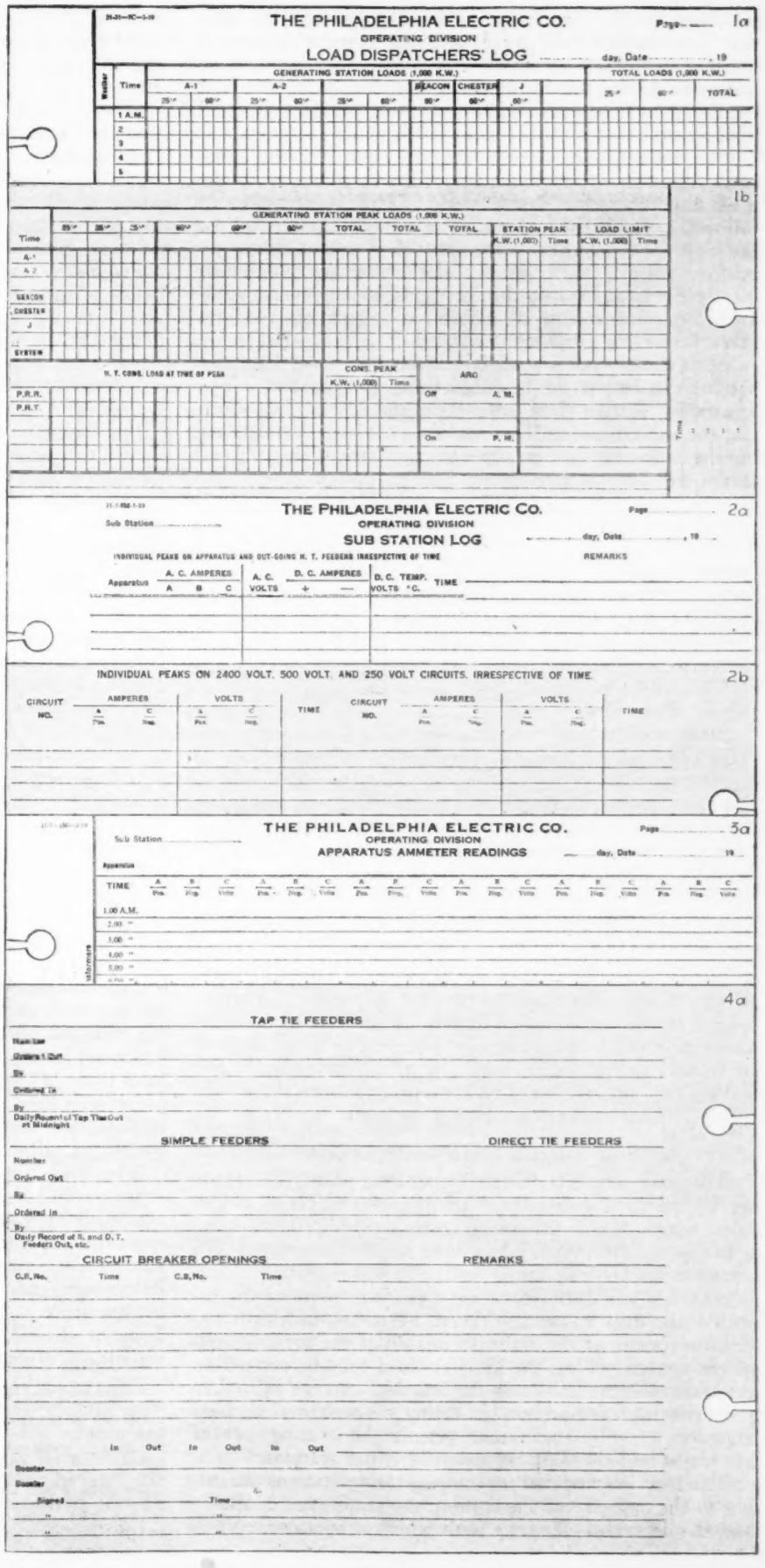
These sheets form the official operating record. From them are made all load curves and load calculations. All station records are numbered the same as the load dispatcher's log. With the exception of the generating station switchboard log, they are all on standard-size sheets, 8½ in. by 11 in. (21.6 cm. by 27.9 cm.). The sheets for the current year are filed in loose-leaf ledger binders, and at the end of the year the load dispatcher's log sheets, the only permanent record, are bound in semi-yearly volumes.

A complete history of operation is contained in the load dispatcher's log book. Therein are entered all interruptions, accidents, operating mistakes, apparatus failures, changes and additions in equipment, and the record of every permit issued. To make this information accessible, a monthly index is kept which classifies all interruptions according to the service affected, all failures according to the type of apparatus, and separates the other happenings into divisions such as storm, operating mistake, unusual operating changes and removals, and new installations.

To enable him to follow the loading at all points on the system and to avoid the duplication of records at the station and the dispatching point, all substation records are forwarded to the dispatcher and filed in his office. Like his system log sheets, they are filed chronologically in ledger binders, a binder for each station. The generating-station switchboard log sheets are filed at the station, since the dispatcher already has a record of the station load on his system log, these readings having been telephoned to him by the station operator hourly or half-hourly as soon as they were calculated; but that he may be posted on the operating details of each station a duplicate copy of the switchboard log for one day of each week is forwarded to him.

The substation log sheet (shown in Fig. 2) is a summary of the data contained on the other substation reports. It contains the statistics of the highest load for the day on each piece of apparatus and outgoing high-tension feeder or distribution circuit and of the load distribution on the various apparatus during the peak load of the station. One-half of the first page is reserved for the diary of the station. The apparatus ammeter readings sheet (Fig. 3) is the record for the day in hourly or half-hourly readings of the load carried on all apparatus and outgoing high-tension feeders. Similar readings for the distribution circuits are taken on a sheet known as the circuit ammeter readings sheet. While the apparatus ammeter sheet gives the instantaneous loads on the apparatus at the various times of day, for railway load the kilowatt-hours-per-hour record is more desirable. Hence the kilowatt-hour meters on motor-generator sets and synchronous converters carrying railway load are read hourly and recorded on the form shown in Fig. 4. The reverse side of this sheet is utilized as a standard form for noting the trippings and switching of the 600-volt railway feeders.

The load of the incoming feeders is not entered on the substation records, and at the generating stations the loads of the outgoing feeders are recorded only for the distributions of the three daily peaks.



Figs. 1a, 1b, 2a, 2b, 3a and 4a—Opposite sides of Load Dispatcher's Logs and Substation Log; Record of Ammeter Readings and System Operator's Record of Blocking Permits.

Readings on the substation tie lines are taken at the station from which they leave, and the generating station tie lines, which are equipped with zero-center double-scale meters to distinguish incoming or outgoing load, are read regularly and correction made for them on the generated load figures.

The industrial substations are provided with the apparatus ammeter sheet, which they fill out and send to the load dispatcher one day a week. This is necessary in following the individual customer's load, since many of the high-tension feeders carry more than one of these customers, and the load registered at the company's station is merely the total load on the feeder. These ammeter readings from the customer are entirely aside from the readings taken for billing purposes.

With these reports accessible in his office, the load dispatcher can follow the loading of the entire system. The generating station data appear on the system log sheet, and the substation log sheets indicate the load carried during the entire day on each piece of apparatus, each outgoing feeder and distribution circuit.

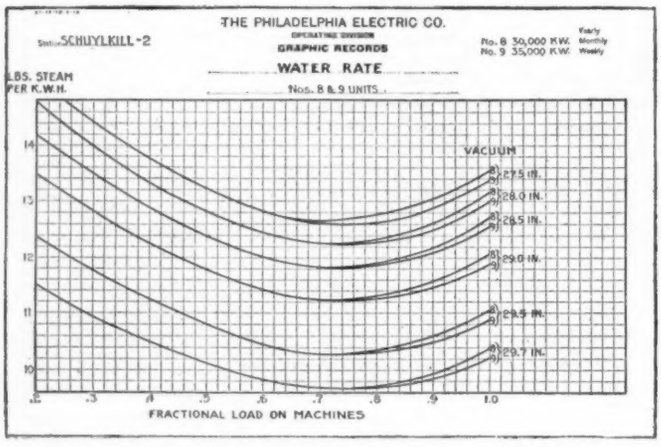


FIG. 5—TURBINE WATER RATE CURVE FROM WHICH MOST ECONOMICAL DIVISION OF LOAD IS DETERMINED

Yearly load-curve cards for all stations and all classes of service are maintained by the load dispatcher. Various special reports are compiled by him, in addition to the daily load curve and report of service prepared by him. In time of trouble he sees to the notifying of all departments and individuals concerned and each morning advises the proper officials of any happenings during the night.

Scheduling Load on Stations

The load schedule for the generating stations is made up by the load dispatcher. In a system as large as this one—which has a generating capacity of 240,000 kva., a peak load of 190,000 kva. and serves an area of 245 square miles (635 sq. km.)—only through a central directing agency could the greatest operating economy be effected and full advantage taken, by means of the transmission system, of the diversity in load at the various parts of the system. Thus the kilowatt load may be carried on the most efficient units and the wattless current shifted to the underloaded machines. During off-peak periods load transfers may be made that permit the cutting out of apparatus and the shutting down of entire stations.

The load is scheduled on the generating stations according to the capacity of the station, the equipment available and the degree of efficiency with which it operates. Various records are available when the capacities of units must be ascertained, but most dispatchers can remember not only the capacities of the units but their operating characteristics as well.

The permit system enables the dispatcher to know the exact apparatus available throughout the system. Considerable information is readily available from the load dispatcher's board, which was described in the Aug. 16 issue. Statistics on operating costs of the stations and a card file showing the efficiency at various loading points of every generating unit facilitate loading the stations economically.

The method of recording the steam consumption of turbines is shown in Fig. 5 for a 30,000-kw. turbine and a 35,000-kw. turbine. The cross-section card on which the curves are drawn is a standard operating department form and is used for daily, weekly, monthly or yearly load curves and for other graphic data.

The number of boilers available and their condition is usually the factor that decides the capacity of the generating station, and this figure the dispatcher carries for each station in the load-limit column of his log sheet. The operation of the individual boilers is a duty of the station superintendent. Beyond establishing the capacity that is to be available, the load dispatcher's duties ordinarily take him no further into the steam end of the station, though his office, as a center of information, working twenty-four hours every day, brings him into contact with every phase of operation and he accumulates more than a passing acquaintance with practically every piece of apparatus and every activity on the system.

Switching Under Dispatcher's Supervision

No generating or load-carrying unit, or the steam or electric auxiliary of any unit without which the operation of the unit might be affected, may be taken out of service without a permit from him, nor may switching be done in the generating station on apparatus of over 2400 volts potential without his knowledge. From the generating station busbars, including the transmission lines, the substation and its equipment, the distribution lines and apparatus up to the low-tension busbars of the high-voltage customer, no switching may be done on any apparatus without his approval—excepting only that switching done according to standardized instructions to restore service in an interruption or in case of emergency. Direct lines from his telephone exchange go to the switchboards of all company stations and the largest industrial substations, and before any routine switching is done the dispatcher is called.

The load dispatcher is responsible for the loading of every part of the system. Though the station operators, who have their switchboard meters to guide them, are responsible for the operation of their apparatus, the dispatcher always knows the apparatus that is on the line and its capacity and must know the load that is being carried or may have to be carried. For his guidance he has his dispatch chart,* giving the exact layout of the system; his file of blueprints, giving the layout of each station;

* The electric dispatch chart of the Philadelphia Electric Company, described in the Aug. 16 issue of the "Electrical World," is made up of separate panels for each station and shows in single line diagram the apparatus in every station. The switches of secondary apparatus are represented by plugs inserted in the panels, and the switches of the main apparatus by lamps which are out when the apparatus is dead or burning under green bulls'-eyes when the apparatus is on the line and red bulls'-eyes when it is blocked out of service. The chart is remotely controlled, the switches for the lamps being located on the dispatcher's telephone desk.

his maps of feeder and circuit routes, and his card index of circuit-breaker and relay settings.

The circuit-breaker and relay settings card is shown in Fig. 6. A card is made out for each such piece of apparatus, and an entry is made on it whenever the setting is checked or altered. The card shows not only the current setting but the type of the breaker or relay and the current-transformer data.

Arrangements for work that would reduce the capacity

Circuit Breakers & Relays 6

Example #——Drawing A/89.——Bus. #——

Date——

Phase	Load Amperes to trip	Current Trans. Ratio	Test Current per Coil	Time Setting	Measure of Coil	Date Tested or Set

THE PHILADELPHIA ELECTRIC CO. 7a
OPERATING DIVISION

Date ..... Time ..... M., Permit No. 9601

Issued by ..... to ..... of the ..... Dept.

Permission is hereby given per .....

to .....

..... at Station .....

Also see Permit No. .....

Cleared by ..... Time ..... M., Date .....

Inspected by ..... Time ..... M., Date .....

FOR DETAILS OF BLOCKING SEE OTHER SIDE

THE PHILADELPHIA ELECTRIC CO. 7b
OPERATING DIVISION

Details of Blocking .....

Permit closed by ..... Time ..... M., Date .....

Immediately upon completion of the work notify Operator in Charge by returning Permit, properly signed. Operator will then notify Load Dispatcher, repeating carefully Permit Number and nature of work for absolute identification.

FIGS. 6, 7A AND 7B—RECORD OF RELAY DATA AND OPPOSITE SIDES OF BLOCKING PERMIT

of any station or affect the customer's load are made in advance with the load dispatcher whenever possible. He ascertains the time most agreeable to the customer to interrupt his load, sets the period during which the work must be done, and arranges with all the departments interested in the job. Ordinarily, on distribution circuits the dispatcher's jurisdiction does not extend beyond maintaining the proper operating conditions on them at the substation; however, through the co-operation existing between his office and the service maintenance department, he becomes familiar with every phase of furnishing adequate service up to the customer's lamp or motor.

No apparatus in any substation or industrial substation may be taken out of service without a permit from him. In the generating stations apparatus under 2400 volts that could not affect the operation of the station or of any unit may be taken out on a "local" permit issued by the chief operator. The permit form is shown in Fig. 7. It is filled out in the same way by the dispatcher and the station operator where the work is being done, but the dispatcher's copy is destroyed after the one from the station has been received and filed in his office. The dispatcher's blanks are already numbered for him, and he issues them in rotation.

A permit is given only to do work, never to block apparatus; all blocking is ordered by the dispatcher. The permit is issued by the dispatcher to the workman, and permission is granted, through the station operator, to do only such work and on or near such apparatus as is listed on the permit. On completion of the work the workman signs his name and the time he cleared the apparatus. The station operator, or the station man in charge of such work, then inspects it, signing his name and the time he "O. K'd" it. All blocks are then removed, and the dispatcher directs whatever tests are desirable before the apparatus is restored to service.

On the reverse side of the permit slip are noted all the blocking details; also the name of the dispatcher closing the permit and the time he did so, which is the time the apparatus went back into service. Separate permits are issued to each department or crew working on the apparatus, and these are cross-indexed to prevent a premature energizing of the apparatus. For each permit issued against any equipment a set of red danger tags bearing the permit number and an injunction against removing them or closing the switch are hung on the disconnecting-switch compartment doors, the control switches, the turbine throttle, or at any other point at which the equipment is blocked.

The co-operation of the industrial substations is readily secured when the necessity of the various operating rules to secure safety and good service is explained to them. Framed instructions to operators are supplied by the company and hung in these plants. Besides the apparatus ammeter sheets, permit blanks and danger tags are furnished to these customers and are handled in the same way as in the company's regular stations. The customer's operators are requested to consult the load dispatcher immediately after any service interruption and in cases of unusual operation, such as arrester discharges, low or unsteady voltage, dim or dead pilot lights. The operating instructions also stipulate the manner of restoring service in an interruption and forbid the paralleling of high-tension feeders at any time without the load dispatcher's instruction to do so.

The personnel of the office includes a chief dispatcher, three dispatchers and three assistant dispatchers. The dispatchers and the assistants rotate in weekly changes over the three eight-hour shifts. There is always at least one dispatcher and an assistant on duty.

The training for the position is necessarily long, and no small part of it is that devoted to cultivating the habits of patience, coolness and quick thinking. The men are selected from the higher generating station positions, and all of them have had previous experience at operating various classes of stations and at construction or maintenance work. The position never becomes monotonously routine. In time of trouble the dispatcher is busy every moment.

Electrical Operation of a Small Textile Mill

Details of Motor Installations, Motor-Control Equipment and Lighting Layout Together With Cost of Lighting and Power Service

BY H. C. N. RIPLEY
Electrical Engineer, Monks & Johnson, Boston, Mass.

THE new "Victory" mill of the Everlastik, Inc., at the corner of Spencer and Webster Avenues, Chelsea, Mass., is a fitting example of the improvement in mill construction and operation brought about by needed rehabilitation and the installation of equipment with electric drives. The original mills, three in number, were driven by a small single-cylinder Corliss engine belted to a line shaft running the entire length of the plant, the shaft being carried on wooden trusses between the several buildings. This engine is now being removed and one of the old mills is being torn down to permit the construction of another building. The remaining two mills, containing about forty-two looms each, are now driven by a 25-hp., 220-volt, three-phase motor. These mills will eventually be replaced by a new mill with individual motor drive similar to the "Victory" mill.

The first addition to the original plant was built in 1909 and was motor-driven throughout. An Allis-Chalmers 20-hp., 220-volt, three-phase induction motor was suspended from the ceiling of each of the three floors and by shafting and belting operated the twenty-one looms on the first and second floors and numerous winding and warping machines on the third floor.

The new mill recently completed is in marked contrast with the other buildings. In the early stages of the design it was decided that each piece of machinery should have its individual motor. This arrangement has not only conserved power, but because of it the plant has a much neater appearance and a beneficial influence is exerted upon the operatives. The unsightly and dangerous overhead shafting and long vertical belts are eliminated, doing away with a constant source of trouble and making the building more pleasant to work in.

Each of the fifty-two twenty-four-shuttle extra-heavy Crompton & Knowles looms, as shown at *C* in the accompanying group of illustrations, is equipped with a 1½-hp. General Electric type KT 220-volt, three-phase induction motor for textile machinery. The motor is controlled by a General Electric No. 151,394 three-phase heavy-duty snap switch with heavy cast-iron cover mounted on a Crouse-Hinds type ZGC condulet containing the proper fuses. All the wiring is done in conduit, and the complete installation is very neat, up-to-date and safe. The warping machines on the third floor (shown at *B*) are equipped with ¼-hp. motors and controlled by General Electric three-phase snap switches mounted on Crouse-Hinds type ZGC condulets supplied with pedestals making the control self-supporting.

The Foster winding machines on the third floor (shown at *A* in the illustration) are equipped with 3-hp. General Electric type KT motors. As these machines are controlled by means of a shipper rod running the entire length of the machine, it was necessary to install a control switch that would lend itself readily to this arrangement. Consequently they were furnished with General Electric type P3 non-automatic quick-make-and-break oil switches, with handle for attaching shipper rod. These switches were protected by type CR-1920 time-limit fuse cut-outs, making a very complete and satisfactory layout.

The finishing machines were moved from one of the old mills into the new mill and changed from belt to individual motor drive. As these machines operate at a very low speed, back-geared motors were required. Cutler-Hammer No. 9320 controllers were used to obtain variable speed. Trumbull "safety type" inclosed knife switches were used to disconnect the motors from the line and were furnished double-throw to allow the reversal of the drying rolls in case of accident. The motors were Northwestern type HW 1-hp., 220-volt, three-phase, 60-cycle, slip-ring designs.

It was the original intention to change the machine shop from belt to individual motor drive, but owing to the difficulty and expense in obtaining attachments for the various machines, this has been abandoned for the present. The complete shop is driven by a 10-hp., 220 volt, three-phase induction motor.

The lighting layout was carefully planned to give the maximum illumination at the minimum expense. An intensity of approximately 5 foot-candles is obtained throughout the building with the exception of the basement, which is used for storage purposes only. Seventy-five-watt type C lamps in Benjamin shallow-dome enameled-steel reflectors spaced approximately 12 ft. (3.6 m.) on centers and mounted 12 ft. above the floor were used in the manufacturing areas. One-hundred-watt and 200-watt type C lamps in Benjamin deep-bowl enameled-steel reflectors, spaced 16 ft. 6 in. (5 m.) apart and 14 ft. (4.2 m.) above the floor, were used in the assembling, inspecting and shipping departments. "Four-in-One" lighting units were used in all of the offices.

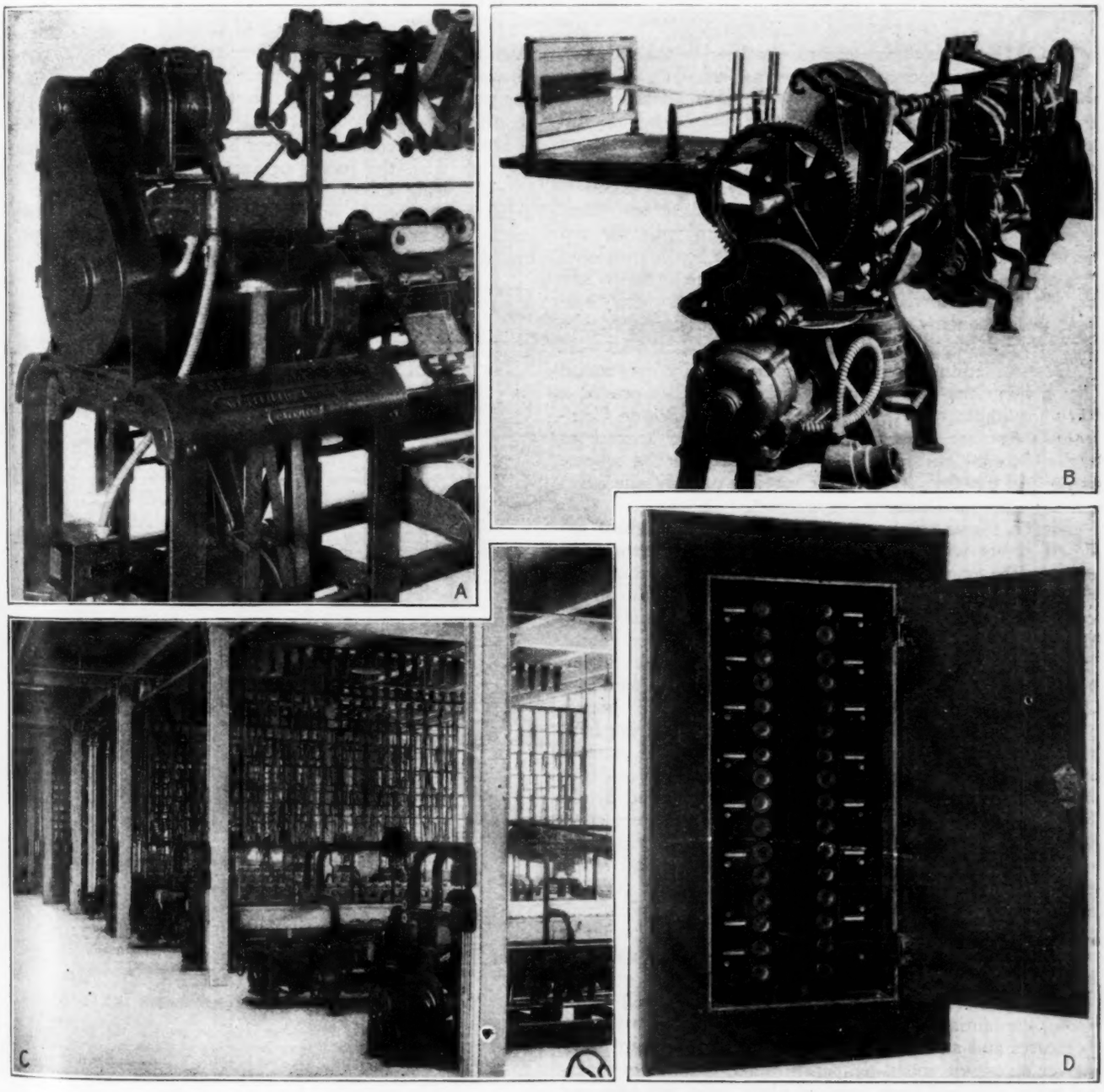
Electrical energy for lighting was formerly generated by a 16-kw. Crocker-Wheeler 110-volt two-wire direct-current generator belted to the shaft driven by the Corliss engine. This was abandoned and all power purchased from the Edison Electric Illuminating Company of Boston—220-volt, three-phase, 60-cycle alternating current. The Edison line enters the property at 4000 volts, three-phase, four-wire, and a 100-kva. three-phase transformer is mounted on a suitable platform just outside of the boiler house to obtain the 220-volt distribution. The Edison meters and the several feeder switches are located in the boiler house, and the distribution to the various buildings is by means of slow-burning weatherproof wire attached to the sides of the buildings. This method of distribution was installed to make use of a large quantity of wiring already in place. The 110 volts for lighting is obtained by three 15-kva. single-phase transformers so placed and connected that the entire plant was well balanced on the three phases.

The power distribution inside of the building is 220-volt, three-phase alternating current; the lighting is 110-

220-volt, three-wire, single-phase. The power distribution panels are the standard slate panel with copper buses and fuses inclosed in a steel cabinet. The lighting panels are made up of Bryant & Perkins No. 2700 panelettes, such as shown at *D* in the accompanying illustration.

The total area of the building is approximately 47,000 sq. ft. (4230 sq. m.); the connected lighting load, 24 kw.; the connected power load, 115 hp. The energy used for lighting is 0.50 watt per square foot; the horsepower per square foot, 0.0024. The cost of the lighting installation per square foot is $0.068, while the cost of the power installation per square foot is $0.036. These costs cover entire equipment except motors.

Monks & Johnson, 99 Chauncey Street, Boston, were the designing engineers, and the M. B. Foster Electric Company, Boston, the electrical contractor.



MOTOR-DRIVE ARRANGEMENTS AND STARTING SWITCHES FOR TEXTILE-MILL MACHINES

A—Foster winding machine motor operated with silent-chain drive. The protective housing for chain and motor bracket are mounted at top of machine frame. The motor leads come up through the floor in conduit with armored flexible conduit between fuse box and quick-break starting switch. The switch is mechanically operated from a horizontal control rod.

B—Warping machine gear-connected to a ¼-hp. motor. The starting switch and fuse box of the unit type are mounted on a floor stand. Armored flexible conduit is used between the switch and the motor.

C—New weave room of Everlastik Mill, showing Crompton-Knowles twenty-four-shuttle extra-heavy looms driven individually by 1½-hp. motors. The starting switches and fuse boxes are shown mounted on columns in the illustration. These will be painted with arrows pointing to the controlled machine. Note the suspension of 75-watt type C lamps by ½-in. pipe hung from a ceiling hook to absorb shocks and permit convenient location as regards sprinkler piping. The loop to suspension pipe is made with asbestos-covered twin conductor from a conduit outlet.

D—Typical lighting cabinet for service in new weave room. Bryant-Perkins panelettes are used provided with 10-amp. fuses and unit switches. Sixteen circuits are controlled from this standard cabinet. One circuit covers two bays in the weave room.

Daily Records of Plant Costs and Efficiencies*

Exceptional Performance of New 20,000-Kw. Power Plant Largely Attributed to System of Records Which Reveal Operating Conditions Daily, Thereby Permitting Immediate Action to Stop Losses

BY J. N. STRIKE
Acme Power Company, Toledo, Ohio

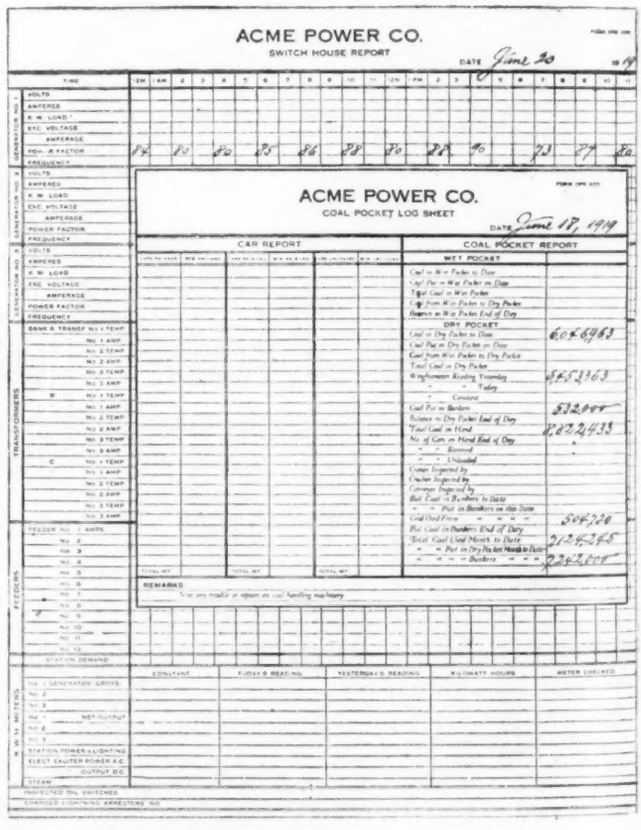
SOME of the large central stations in this country are being operated at a thermal efficiency of 9 per cent or 10.5 per cent at the switchboard when many of them have equipment that should be able to produce 14 per cent efficiency. However, the maximum efficiency cannot be obtained unless the operating costs and efficiencies can be determined daily. Many accounting systems fail in this requirement because the management and operating engineers have to wait for ten or fifteen days after the previous month's books are closed for a report. This sometimes shows an abnormally low efficiency for the whole period, whereas by the daily system poor economy could be detected and corrected the following day.

Determination of costs and efficiencies daily may sound like a laborious and expensive task, but it has proved a very profitable undertaking for the Acme Power Company. At first it seemed almost prohibitive because of the additional auditing believed necessary, but a scheme is now in use that requires the services of only one extra clerk in the bookkeeping department.

Eleven forms or sheets are used. Seven of these are detail sheets which are filled out by the operators and sent to the office at the end of every twenty-four-hour period. A complete record is kept of the amount of coal entering the yard, car number and initials, cars unloaded in dry pocket or storage, coal delivered to the boiler department, and fuel remaining in stock unconsumed for the day and month. In the boiler room is a data sheet for each boiler in service, on which is hourly recorded coal received and consumed from the firing bins, together with all operating data, such as steam pressure and temperature, and furnace performances, such as draft, air pressure and flue-gas temperature, all recorded by the hour and total for one day. With this data sheet come the daily recording charts from instruments in the boiler department, such as boiler-steam flow meters and steam flow in pounds per hour, air flow through the furnace, stokers, speed from which coal consumed is calculated, wind-box pressure under the fire, draft conditions over the fire, flue-gas temperature, temperature and quality of steam generated, and per cent CO_2.

Another data sheet is kept for the heater and pump room, containing data on water fed to the boilers, temperatures and amount of condensate returned from prime mover or engine room, temperature and amount of make-up water supplied from treating plant, total amounts and temperatures of water fed to boilers (all measured by V-notch meters on recording charts), amount of exhaust steam used in heating feed water and total of all quantities for the twenty-four-hour day. Another data sheet of this department is one for the plant treating make-up water for use in the boiler department. This sheet contains number of pounds of water treated and constituency of water before and after treating in grains of hardness per gallon, together with amount of chemicals used in the treating process.

Data gathered on the four sheets mentioned so far, together with the recording instrument charts, are used in calculating the total input and output of the boiler department, both in quantities and rate of efficiency, and the results are carried forward on another form of general data sheet which will be explained later. Provisions


ACME POWER CO.
SWITCH HOUSE REPORT
DATE June 20 19 17

ACME POWER CO.
COAL POCKET LOG SHEET
DATE June 17, 1917

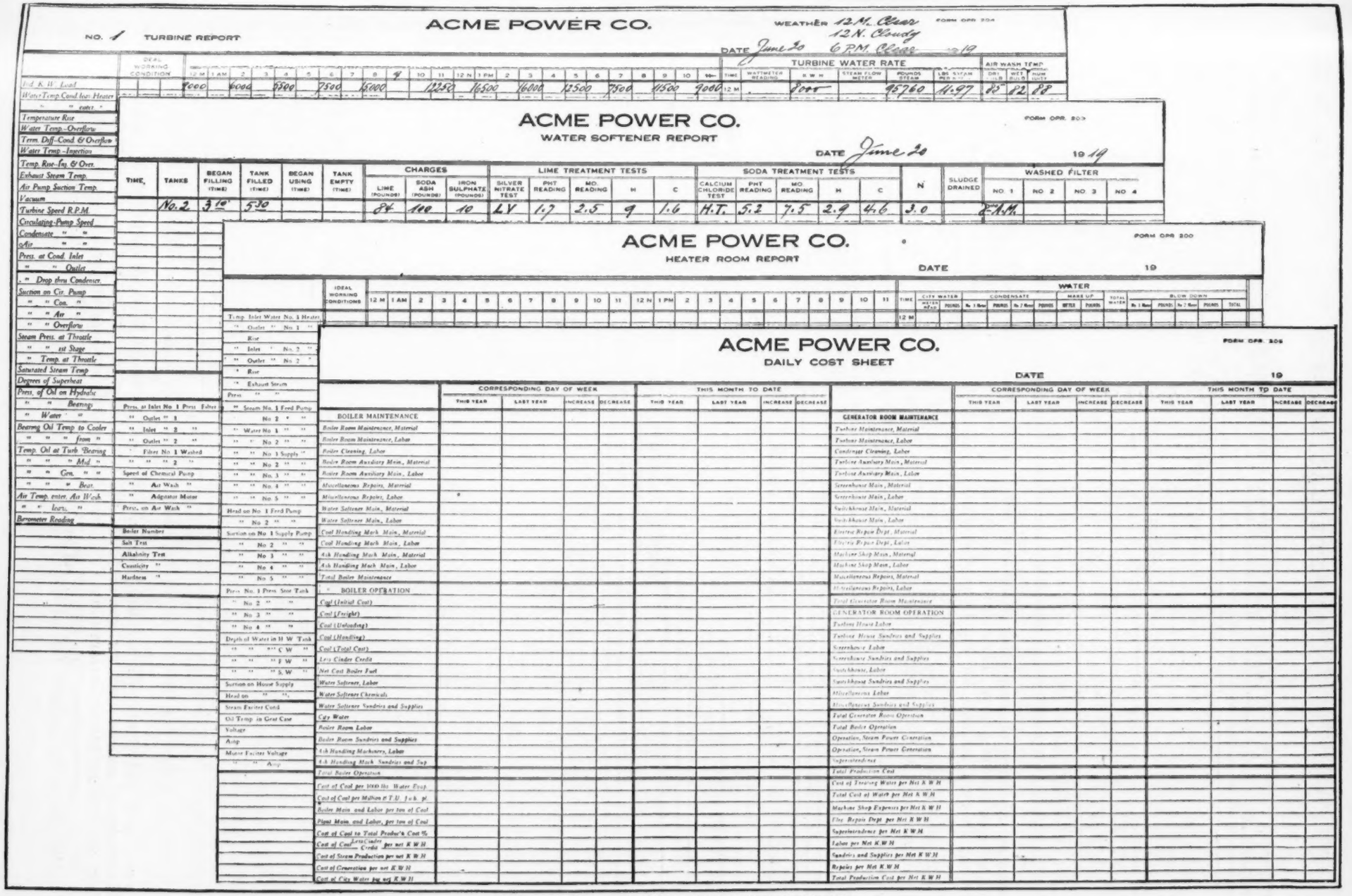
CAR REPORT
COAL POCKET REPORT
WET POCKET
DRY POCKET
6046963
5452363
532600
1082435
504720
2124585
2342000
REMARKS

FIG. 1—LOAD AND COAL REPORT SHEETS
Some typical figures have been filled in. Both forms as shown have had the space allowed for "remarks" trimmed off, also the 2-in. strip for filing. The full size of the switch house report is 12 in. by 21 in., and the coal pocket log sheet is 12 in. by 11½ in. These forms are used in conjunction with those shown in Figs. 2 and 4.

are made for reporting all maintenance work, materials and labor for the day, and there is a large space for general remarks.

In the prime-mover or engine room the data sheet used is very much like the one described for the boiler department, containing only the total operating data of the turbine and generator in total pounds of steam used per hour, weights, temperatures and quantity, condenser

*Paper presented before twenty-fifth annual convention of Ohio Electric Light Association, Cedar Point, Ohio.



ACME POWER CO.

NO. 1 TURBINE REPORT

WEATHER 12 M. Clear 12 N. Cloudy 6 PM. Clear

DATE June 20 19

	IDEAL WORKING CONDITION	12 M	1 AM	2	3	4	5	6	7	8	9	10	11	12 N	1 PM	2	3	4	5	6	7	8	9	10	11
Ind. K. W. Load		7000		6000		5500		7500		15000			12250		16500		16000		12500		7500		11500		9000
Water Temp Cond. leav. Heater																									
" " enter. "																									
Temperature Rise																									
Water Temp.-Overflow																									
Term. Diff.-Cond. & Overflow																									
Water Temp.-Injection																									
Temp. Rise-Inj. & Over.																									
Exhaust Steam Temp.																									
Air Pump Suction Temp.																									
Vacuum																									
Turbine Speed R.P.M.																									
Circulating-Pump Speed																									
Condensate " "																									
Air " "																									
Press. at Cond. Inlet																									
" " Outlet																									
" " Drop thru Condenser																									
Suction on Cir. Pump																									
" " Con. "																									
" " Air "																									
" " Overflow																									
Steam Press. at Throttle																									
" " 1st Stage																									
" Temp. at Throttle																									
Saturated Steam Temp																									
Degrees of Superheat																									
Press. of Oil on Hydralic																									
" " Bearings																									
" Water "																									
Bearing Oil Temp. to Cooler																									
" " " from "																									
Temp. Oil at Turb. Bearing																									
" " " Mid. "																									
" " " Gen. " "																									
" " " Brgs.																									
Air Temp. enter. Air Wash																									
" " leav. "																									
Barometer Reading																									

	TURBINE WATER RATE				AIR WASH TEMP		
TIME	WATTMETER READING	K.W.H.	STEAM FLOW METER	POUNDS STEAM	LBS. STEAM PER K.W.	DRY BULB	WET BULB	HUM IDITY
12 M		8000		95760	11.97	85	82	88

ACME POWER CO.

WATER SOFTENER REPORT

DATE June 20 19 19

TIME	TANKS	BEGAN FILLING (TIME)	TANK FILLED (TIME)	BEGAN USING (TIME)	TANK EMPTY (TIME)	CHARGES: LIME (POUNDS)	SODA ASH (POUNDS)	IRON SULPHATE (POUNDS)	LIME TREATMENT TESTS: SILVER NITRATE TEST	PHT READING	MO. READING	H	C	SODA TREATMENT TESTS: CALCIUM CHLORIDE TEST	PHT READING	MO. READING	H	C	N	SLUDGE DRAINED	WASHED FILTER: NO. 1	NO. 2	NO. 3	NO. 4
	No. 2	3 10	5 30			84	100	10	LV	1.7	2.5	9	1.6	H.T.	5.2	7.5	2.9	4.6	3.0	2nd A.M.				

ACME POWER CO.

HEATER ROOM REPORT

DATE 19

	IDEAL WORKING CONDITIONS	12 M	1 AM	2	3	4	5	6	7	8	9	10	11	12 N	1 PM	2	3	4	5	6	7	8	9	10	11
Temp. Inlet Water No. 1 Heater																									
" Outlet " No. 1 "																									
Rise																									
" Inlet " No. 2 "																									
" Outlet " No. 2 "																									
" Rise																									
" Exhaust Steam																									
Press " "																									

TIME	WATER: CITY WATER METER READ	CITY WATER POUNDS	CONDENSATE No. 1 Heater	CONDENSATE POUNDS	CONDENSATE No. 2 Heater	CONDENSATE POUNDS	MAKE UP METER	MAKE UP POUNDS	TOTAL WATER	BLOW DOWN No. 1 Heater	BLOW DOWN POUNDS	BLOW DOWN No. 2 Heater	BLOW DOWN POUNDS	BLOW DOWN TOTAL
12 M														

Press. at Inlet No. 1 Press. Filter	
" Outlet " 1	
" Inlet " 2	
" Outlet " 2	
Filter No. 1 Washed	
" " " 2	
Speed of Chemical Pump	
" Air Wash "	
" Adjustor Motor	
Press. on Air Wash "	
Boiler Number	
Salt Test	
Alkalinity Test	
Causticity "	
Hardness "	

" " Steam No. 1 Feed Pump	
" No. 2 " "	
" Water No. 1 " "	
" " No. 2 " "	
" " No. 3 Supply "	
" " No. 2 " "	
" " No. 3 " "	
" " No. 4 " "	
" " No. 5 " "	
Head on No. 1 Feed Pump	
" No. 2 " "	
Suction on No. 1 Supply Pump	
" No. 2 " "	
" No. 3 " "	
" No. 4 " "	
" No. 5 " "	
Press. No. 1 Press. Stor. Tank	
" No. 2 " "	
" No. 3 " "	
" No. 4 " "	
Depth of Water in H. W. Tank	
" " " C. W. "	
" " " F. W. "	
" " " S. W. "	
Suction on House Supply	
Head on " "	
Steam Exciter Cond.	
Oil Temp. in Gear Case	
Voltage	
Amp.	
Motor Exciter Voltage	
" " Amp.	

ACME POWER CO.

DAILY COST SHEET

DATE 19

	CORRESPONDING DAY OF WEEK: THIS YEAR	LAST YEAR	INCREASE	DECREASE	THIS MONTH TO DATE: THIS YEAR	LAST YEAR	INCREASE	DECREASE
BOILER MAINTENANCE								
Boiler Room Maintenance, Material								
Boiler Room Maintenance, Labor								
Boiler Cleaning, Labor								
Boiler Room Auxiliary Main., Material								
Boiler Room Auxiliary Main., Labor								
Miscellaneous Repairs, Material								
Miscellaneous Repairs, Labor								
Water Softener Main., Material								
Water Softener Main., Labor								
Coal Handling Mach. Main., Material								
Coal Handling Mach. Main., Labor								
Ash Handling Mach. Main., Material								
Ash Handling Mach. Main., Labor								
Total Boiler Maintenance								
" BOILER OPERATION								
Coal (Initial Cost)								
Coal (Freight)								
Coal (Unloading)								
Coal (Handling)								
Coal (Total Cost)								
Less Cinder Credit								
Net Cost Boiler Fuel								
Water Softener, Labor								
Water Softener Chemicals								
Water Softener Sundries and Supplies								
City Water								
Boiler Room Labor								
Boiler Room Sundries and Supplies								
Ash Handling Machinery, Labor								
Ash Handling Mach. Sundries and Sup.								
Total Boiler Operation								
Cost of Coal per 1000 lbs. Water Evap.								
Cost of Coal per Million B.T.U. Input								
Boiler Main. and Labor per ton of Coal								
Plant Main. and Labor, per ton of Coal								
Cost of Coal to Total Produc'n Cost %								
Cost of Coal Less Cinder Credit per net K.W.H.								
Cost of Steam Production per net K.W.H.								
Cost of Generation per net K.W.H.								
Cost of City Water per net K.W.H.								

	CORRESPONDING DAY OF WEEK: THIS YEAR	LAST YEAR	INCREASE	DECREASE	THIS MONTH TO DATE: THIS YEAR	LAST YEAR	INCREASE	DECREASE
GENERATOR ROOM MAINTENANCE								
Turbine Maintenance, Material								
Turbine Maintenance, Labor								
Condenser Cleaning, Labor								
Turbine Auxiliary Main., Material								
Turbine Auxiliary Main., Labor								
Generator Main., Material								
Generator Main., Labor								
Switchboard Main., Material								
Switchboard Main., Labor								
Electric Repair Dept., Material								
Electric Repair Dept., Labor								
Machine Shop Main., Material								
Machine Shop Main., Labor								
Miscellaneous Repairs, Material								
Miscellaneous Repairs, Labor								
Total Generator Room Maintenance								
GENERATOR ROOM OPERATION								
Turbine House Labor								
Turbine House Sundries and Supplies								
Generator Labor								
Generator Sundries and Supplies								
Switchboard, Labor								
Switchboard Sundries and Supplies								
Miscellaneous Labor								
Miscellaneous Sundries and Supplies								
Total Generator Room Operation								
Total Boiler Operation								
Operation, Steam Power Generation								
Operation, Steam Power Generation								
Superintendence								
Total Production Cost								
Cost of Treating Water per Net K.W.H.								
Total Cost of Water per Net K.W.H.								
Machine Shop Expenses per Net K.W.H.								
Elec. Repair Dept. per Net K.W.H.								
Superintendence per Net K.W.H.								
Labor per Net K.W.H.								
Sundries and Supplies per Net K.W.H.								
Repairs per Net K.W.H.								
Total Production Cost per Net K.W.H.								

FIG. 2—POWER-PLANT DAILY REPORT FORMS

The full size of the forms shown is 12 in. by 21 in. The 2 in. allowed for filing the forms in a loose-leaf book is not shown. The figures which have been filled in are typical. The additional forms required for the complete daily power plant record are shown in Figs. 1 and 3.

TABLE I.—OPERATING DATA FROM 20,000-KW. PLANT.

These figures were taken from the general data form (see Fig. 4) for June 20, 1919. There was only one 20,000-kw. turbine in the station at this time, but another machine is being added and the ultimate capacity of the plant will be 200,000 kw.

	Corresponding Day of Week				This Month to Date			
	This Year	Last Year	Increase	Decrease	This Year	Last Year	Increase	Decrease
Gross generation	266,000	189,000	77,000	.....	3,912,000	3,245,000	.....	.....
Station power	3,000	8,600	.....	5,600	51,000	147,400	.....	96,400
Used for station lighting	1,000	1,000	.....	.....	17,000	17,000	.....	.....
Kw. station demand	17,000	11,000	6,000	.....	17,000	13,500	3,500	.....
Station load factor	64.2	68	.....	3.8	57.95	59.2	.....	1.25
Pounds water per net kw.-hr.	14.31	17.34	.....	3.03	15.05	17.97	.....	2.92
Pounds of water evaporated per lb. of coal	7.02	7.6	.....	0.58	7.12	7.84	.....	0.72
Pounds of coal per net kilowatt-hour	2.043	2.085	.....	0.042	2.118	2.297	.....	0.179
B.t.u. per net kw.-hr.	24,750	23,710	1,040	.....	25,880	27,150	.....	1,270
Boiler plant efficiency	64.7	70.2	.....	5.5	64.9	72.5	.....	7.6
Switchboard, thermal efficiency	13.74	14.31	.....	0.5	13.15	12.5	0.65	.....
Average B.t.u. per pound coal	12,102	11,372	730	.....	12,222	11,820	402	.....
Water rate	12.41	12.27	.....	.....	12.6	.....	.....	.....

performance, efficiency of condensing equipment, also turbine and generator efficiency. These items are reported hourly and in total amounts for the twenty-four-hour day.

In the switching room data on the energy generated hourly are recorded, together with the station and feeder results department checks and totals and enters the general data on a summary sheet. This carries the complete plant performance in amounts and per cent of efficiency of the plant in general for the current day and month as well as for the year previous. It also indicates percentages of increase or decrease for the day and month

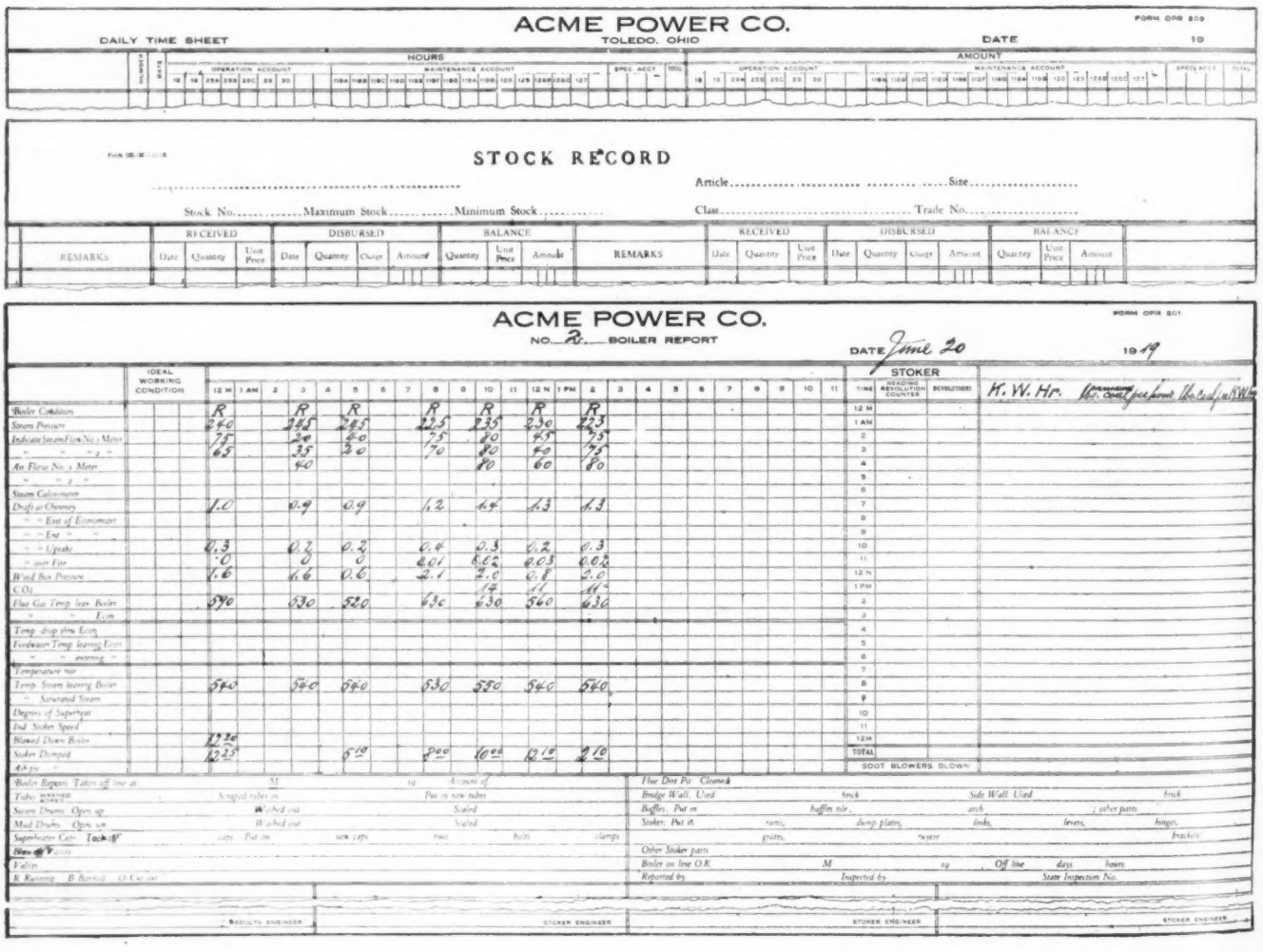


FIG. 3—FORMS FOR DAILY TIME SHEET, STOCK RECORD AND BOILER-ROOM OPERATING CONDITIONS

load power generated (both gross and net), total output in kilowatt-hours, amount used for station power and lighting, and data on battery performance.

Each of the above-mentioned data sheets is sent to the desk of the plant chief engineer for his approval. The over last year. Reported on this sheet is a complete heat balance of the station, and by careful study of data contained the station manager is able to correct any one item of plant operation before it results in the loss of a very large sum of money.

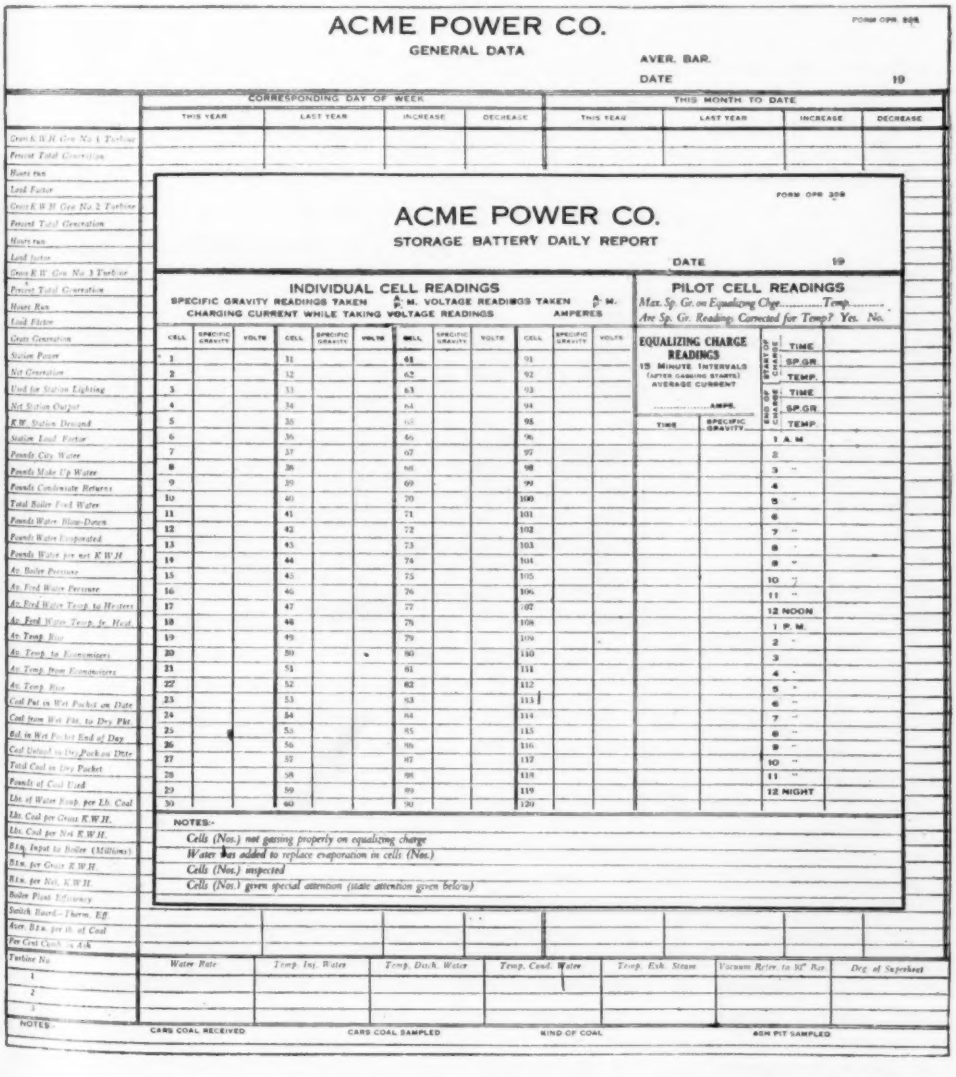
TABLE II.—VARIATION IN COAL CONSUMPTION FROM HOUR TO HOUR

The figures are taken from No. 2 boiler report (see Fig. 3) dated June 20, 1919. The great difference between 1.62 lb. per kilowatt-hour as a minimum and 2.79 lb. per kilowatt-hour as a maximum during different hours of the same day emphasizes the necessity of frequent checks on operating conditions such as are made up at the Acme Power Company's plant.

Kw.-Hr.	Lbs. Coal per Hr.	Lbs. Coal per Kw.-Hr.
8,000	19,680	2.43
8,000	15,360	1.92
6,000	12,960	2.16
6,000	14,400	2.40
6,000	10,320	1.72
5,000	13,680	2.73
6,000	15,120	2.52
9,000	24,960	2.79
14,000	28,560	2.04
17,000	33,600	1.97
15,000	32,360	2.15
17,000	32,880	1.93
14,000	26,400	1.88
15,000	27,840	1.85
14,000	27,600	1.97
17,000	29,280	1.72
16,000	36,240	2.26
14,000	22,320	1.59
11,000	21,120	1.92
9,000	16,800	1.87
8,000	14,640	1.83
9,000	20,640	2.29
12,000	27,600	2.30
9,000	14,640	1.63

Total input in money and total amount of output per kilowatt-hours are entered on another sheet, which is the unit cost sheet. From the time-keeper's desk comes a daily time distribution form bearing the name and number of every one working in the power-producing department. Laid out on this report is a column for every operating and maintenance account as set up in the company's classification of production operating accounts. Each employee's time is distributed both in hours and money to each classification, and the total amounts are placed on the unit cost sheet, which is set up in classifications as will be described later. The daily time sheet not only shows the total time in hours and money, but shows at a glance if any one classification is being charged too heavily or if the department is exceeding the labor cost previously estimated to be expended. It serves as a good labor guide to the station manager.

Another important part of the system is that of the stock record. In conducting a cost system it is very necessary to keep a very close account of materials in stock, as all purchase requisitions for coal or any other material



ACME POWER CO.

GENERAL DATA

AVER. BAR.

DATE 19

CORRESPONDING DAY OF WEEK — THIS YEAR | LAST YEAR | INCREASE | DECREASE

THIS MONTH TO DATE — THIS YEAR | LAST YEAR | INCREASE | DECREASE

Gross K.W.H. Gen. No. 1 Turbine
Percent Total Generation
Hours run
Load Factor
Gross K.W.H. Gen. No. 2 Turbine
Percent Total Generation
Hours run
Load factor
Gross K.W. Gen. No. 3 Turbine
Percent Total Generation
Hours Run
Load Factor
Gross Generation
Station Power
Net Generation
Used for Station Lighting
Net Station Output
K.W. Station Demand
Station Load Factor
Pounds City Water
Pounds Make Up Water
Pounds Condensate Returns
Total Boiler Feed Water
Pounds Water Blow-Down
Pounds Water Evaporated
Pounds Water per net K.W.H.
Av. Boiler Pressure
Av. Feed Water Pressure
Av. Feed Water Temp. to Heaters
Av. Feed Water Temp. fr. Heat.
Av. Temp. Rise
Av. Temp. to Economizers
Av. Temp. from Economizers
Av. Temp. Rise
Coal Put in Wet Pocket on Date
Coal from Wet Pkt. to Dry Pkt.
Bal. in Wet Pocket End of Day
Coal Unload. in Dry Pock on Date
Total Coal in Dry Pocket
Pounds of Coal Used
Lbs. of Water Evap. per Lb. Coal
Lbs. Coal per Gross K.W.H.
Lbs. Coal per Net K.W.H.
B.t.u. Input to Boiler (Millions)
B.t.u. per Gross K.W.H.
B.t.u. per Net K.W.H.
Boiler Plant Efficiency
Switch Board—Therm. Eff.
Aver. B.t.u. per lb. of Coal
Per Cent Combustible in Ash

ACME POWER CO.

STORAGE BATTERY DAILY REPORT

DATE 19

INDIVIDUAL CELL READINGS

SPECIFIC GRAVITY READINGS TAKEN ☐ P. M. VOLTAGE READINGS TAKEN ☐ P. M.

CHARGING CURRENT WHILE TAKING VOLTAGE READINGS AMPERES

CELL	SPECIFIC GRAVITY	VOLTS	CELL	SPECIFIC GRAVITY	VOLTS	CELL	SPECIFIC GRAVITY	VOLTS	CELL	SPECIFIC GRAVITY	VOLTS
1			31			61			91		
2			32			62			92		
3			33			63			93		
4			34			64			94		
5			35			65			95		
6			36			66			96		
7			37			67			97		
8			38			68			98		
9			39			69			99		
10			40			70			100		
11			41			71			101		
12			42			72			102		
13			43			73			103		
14			44			74			104		
15			45			75			105		
16			46			76			106		
17			47			77			107		
18			48			78			108		
19			49			79			109		
20			50			80			110		
21			51			81			111		
22			52			82			112		
23			53			83			113		
24			54			84			114		
25			55			85			115		
26			56			86			116		
27			57			87			117		
28			58			88			118		
29			59			89			119		
30			60			90			120		

PILOT CELL READINGS

Max. Sp. Gr. on Equalizing Chge.....Temp.....

Are Sp. Gr. Readings Corrected for Temp? Yes. No.

EQUALIZING CHARGE READINGS

15 MINUTE INTERVALS (AFTER CHARGING STARTS) AVERAGE CURRENT

..... AMPS.

TIME	SPECIFIC GRAVITY

END OF CHARGE — TIME | SP.GR. | TEMP.

START OF CHARGE — TIME | SP.GR. | TEMP.

1 A. M. | 2 " | 3 " | 4 " | 5 " | 6 " | 7 " | 8 " | 9 " | 10 " | 11 " | 12 NOON | 1 P. M. | 2 " | 3 " | 4 " | 5 " | 6 " | 7 " | 8 " | 9 " | 10 " | 11 " | 12 NIGHT

NOTES:-

Cells (Nos.) not gassing properly on equalizing charge

Water was added to replace evaporation in cells (Nos.)

Cells (Nos.) inspected

Cells (Nos.) given special attention (state attention given below)

Turbine No.	Water Rate	Temp. Inj. Water	Temp. Disch. Water	Temp. Cond. Water	Temp. Exh. Steam	Vacuum Refer. to 30" Bar.	Deg. of Superheat
1							
2							
3							

NOTES:

CARS COAL RECEIVED — CARS COAL SAMPLED — KIND OF COAL — MIN PIT SAMPLED

FIG. 4—FORMS FOR GENERAL DATA AND BATTERY REPORT

The items listed on the left-hand side of the general data sheet are listed in Table III. These forms are of the same size as the forms in Fig. 1 and are used in conjunction with the forms in Figs. 1 and 2 in obtaining the complete record of the power plant operation.

TABLE III.—INFORMATION REQUIRED DAILY.

Gross kilowatt-hours generated No. 1 turbine.
Per cent total generation.
Hours run. Load factor.
Gross kilowatt-hours generated No. 2 turbine.
Per cent total generation
Hours run. Load factor
Gross kilowatts generated No. 3 turbine.
Per cent total generation.
Hours run. Load factor.
Load factor.
Gross generation.
Station power.
Net generation.
Used for station lighting.
Net station output.
Station demand, kilowatts.
Station load factor.
Pounds city water.
Pounds make-up water.
Pounds condensate returns.
Total boiler-feed water.
Pounds water blow-down.
Pounds water evaporated.
Pounds water per net kw.-hr.
Average boiler pressure.
Average feed-water pressure.
Average feed-water temperature to heaters.
Average feed-water temperature from heaters.
Average temperature rise.
Average temperature to economizers.
Average temperature from economizers.
Average temperature rise.
Coal put in wet pocket on date.
Coal from wet pocket to dry pocket.
Balance in wet pocket end of day.
Coal unloaded in dry pocket on date.
Total coal in dry pocket.
Pounds of coal used.
Pound of water evaporated per pound of coal.
Pound coal per gross kilowatt-hr.
Pound coal per net kilowatt-hr.
B.t.u. input to boiler (millions).
B.t.u. per gross kilowatt-hours.
B.t.u. per net kilowatt-hours.
Boiler-plant efficiency.
Switchboard, thermal efficiency.
Average B.t.u. per pound of coal.
Per cent combustible in ash.
Turbine number
Water rate.
Temperature injector water.
Temperature discharge water.
Temperature condenser water.
Temperature exhaust steam.
Vacuum referred to 30 deg.
Degree of superheat, barometer.

used, or expected to be used, in the operation of the plant are charged to stock. Every article purchased goes through the stock records. A requisition is issued when anything is taken from the stock room, and the material is charged to the operating account for which it was used. The requisition, after being properly signed, is passed through the stock records and priced and credited to the account against which it was charged at the time of entering stock. The stock requisition then passes on to the unit cost blank, where it is entered under the proper operating classification of the station.

The sheets which carry the data to make up the unit cost sheet are the general data sheet, the time distribution sheet and the shop requisitions. The unit cost sheet is divided into classified divisions between operation and maintenance for the boiler department, total operation, total maintenance, total production and numerous other items, such as total maintenance per kilowatt-hour generated, total generating cost per kilowatt-hour, boiler maintenance per ton of coal firing and cost per 1000 lb. of steam generated. In fact, every item of operation and maintenance which has to do with the production department is audited on this sheet. The general and office expense, interest and taxes, obsolescence and gross and net earnings of the company are not included, but there are about ninety other items taken into account and reported on this daily unit-cost sheet.

The system has been in use more than a year and has been found to be an excellent check on the bookkeeping department. The actual value of the system cannot be estimated, but it is certain that the high operating efficiency and economy of the new station at East Toledo can be attributed chiefly to the close supervision permitted by this daily accounting method.

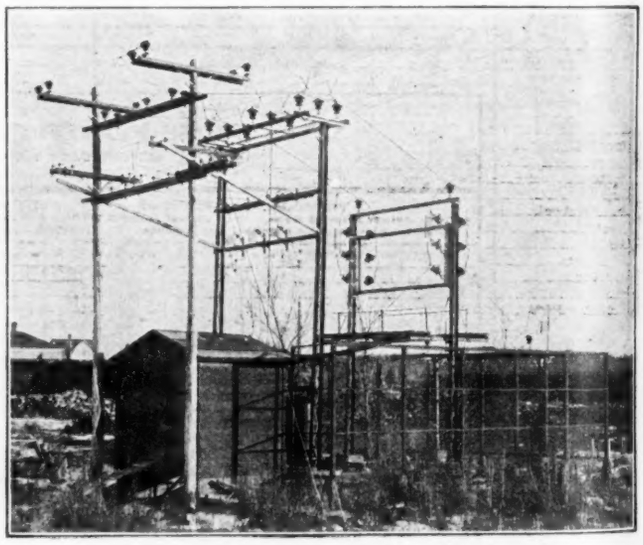
One of the many interesting features about this plant is that the firemen know hour by hour the coal consumption per kilowatt-hour. Underfeed stokers are in use and a counter is connected to each one. A constant has been figured out which, when multiplied by the number of revolutions for the stoker counters, give the number of pounds of coal consumed. This is figured up hourly and the electrical department telephones the kilowatt-hours consumed during the same period. By this system the firemen are kept advised of the coal consumption for each kilowatt-hour generated during the preceding hour.

FROM now on the particular duty of the company to its customers is to render satisfactory service; to its employees, to maintain loyalty by fair treatment; to those who own its securities, to maintain integrity of their investment, and to others of the commonwealth, under whose rules and regulations it operates, to convey the information that it is giving them better service for less money than can be obtained in any other way even under government ownership. Our business is founded on an economic basis, and if wisely administered and not hampered by unfair treatment can continue mutually beneficial to the customer, to labor, to capital and the commonwealth. — *Everett W. Cole, before New Bedford (Mass.) Gas & Edison Light Company employees.*

SUBSTATIONS DESIGNED TO PERMIT FUTURE CHANGES

Provide for Doubling Voltage, for Complete Three-Phase Operation and for Larger Transformers in Outdoor Substations

SUBSTATIONS are being designed to permit flexibility of extension with due regard for any conceivable future development. Substations of the Wisconsin Valley Electric Company, Wausau, are noteworthy examples of this design. This procedure is partly due to the fact that the company operates a system on which a number of hydroelectric and steam plants are feeding into the network. Some of the plants are now owned by the utility company and some are the property of industrial concerns. All are connected so that each industrial plant may give or take power. The Wisconsin Valley company owns three plants. These comprise hydroelectric plants at Merrill and at Stevens Point and a combination steam-hydroelectric plant at Wausau. These three plants are interconnected, and, in addition to this, connections are also made to the steam-hydroelectric plant of the Marathon Paper Mills Company at Rothschild, to the steam-hydroelectric plant of the Wausau Sulphate Fiber Company at Mosinee, to the steam-hydroelectric plant of the Whiting-Plover Paper Company at Stevens Point, and to the hydroelectric plant of the Consolidated Water Power & Paper Company at Stevens Point. Some of the standard substations used are shown on page 875.



SINGLE-PHASE SUBSTATION LAYOUT EASILY CONVERTIBLE FOR THREE-PHASE OPERATION

This standard installation at Edgar, Wis., is operating single-phase at present. It can easily be changed to operate three-phase by adding transformers and one additional choke coil, fuse and arrester equipment. The middle pole of the switch is not used at present.

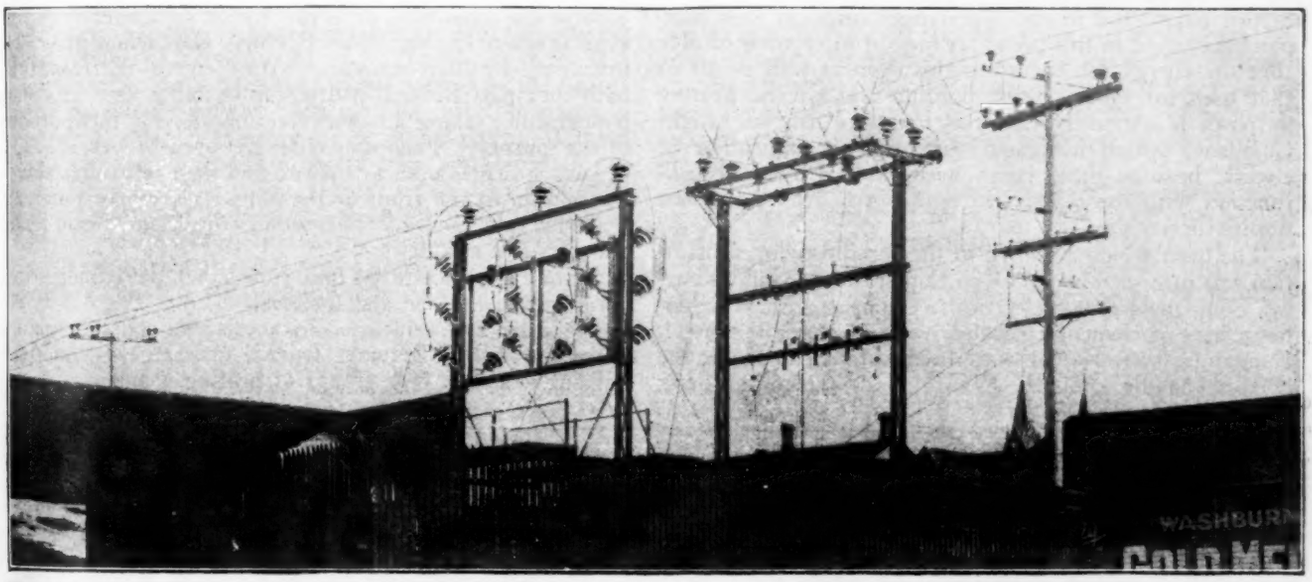
These standard substations are of the unit-type steel-tower construction, made with interchangeable elements to reduce the necessary stock of replacement parts. They are being supplied from three-phase, 60-cycle lines constructed for 44,000-volt operation but initially operated at 22,000/2200 volts. They are also designed so that the ratings may be increased by simply installing larger transformers and changing the fuses. This permits of growth to take care of future needs.

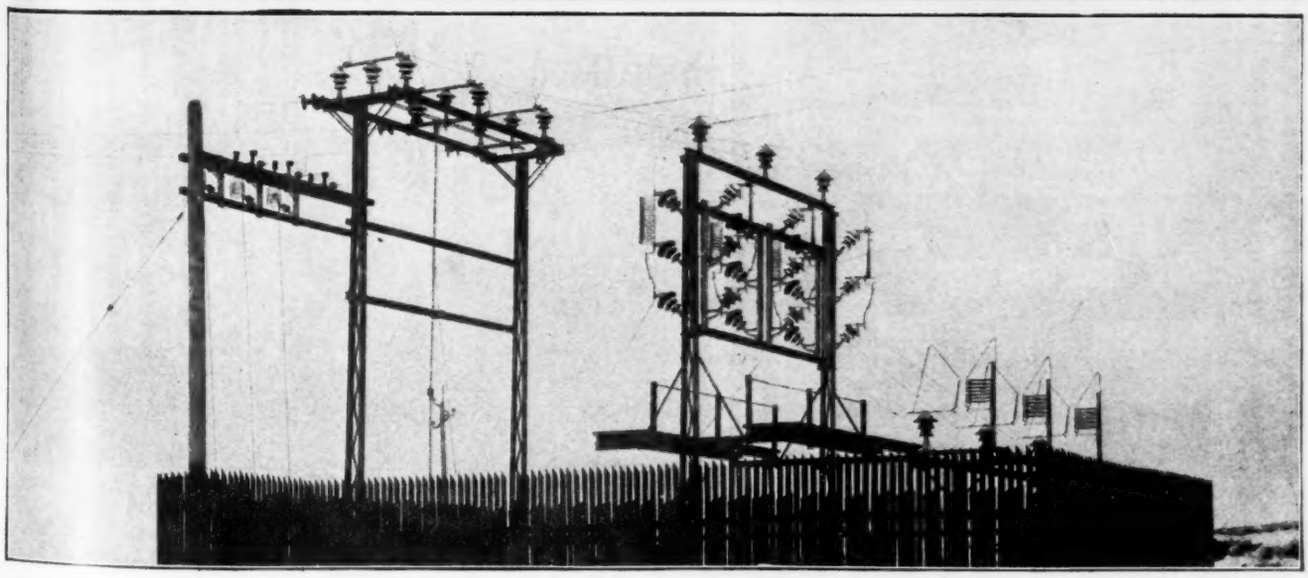
Two main expanded steel structures are used at each substation. One supports the three-pole double-break-per-phase air-break switch. The other supports the high-tension disconnecting switches, carbon-tetrachloride fuses and long-turn cylindrical choke coils. A smaller adjacent steel structure is used to support the high-speed sphere-gap, graded-resistance lightning arresters. A three-pole, 44,000-volt switch mounted on the higher structure is equipped with an interlocked remote-control mechanism, permitting all three phases to be simultaneously opened and closed from the ground level.

These substations were erected by the Wisconsin Valley Electric Company under the management of M. C. Ewing and under the direct supervision of Grant Ford, electrical engineer for the company. The transformers were supplied by the Moloney Electric Company, the steel poles by the Bates Expanded Steel Truss Company and the other equipment by the Delta-Star Electric Company, Chicago.

Electric Power from Streams of Small Size

In order to encourage the development of small water powers for use on farms, Bulletin No. 770 has been issued by the Department of Agriculture. In this bulletin, edited by A. M. Daniels, the power requirements for illumination, for small appliances, heating devices and also for the operation of different farm machines have been listed to aid the farmer in deciding on the capacity of plant he requires.





FIGS. 1 AND 2—STANDARDIZED SUBSTATION SUPPLYING MARATHON CITY, WIS., AND SAME TYPE OF STATION FOR SINGLE CUSTOMER

Three 25-kva., 44,000/22,000/2200-volt, 60-cycle, single-phase transformers are now installed in the station shown in Fig. 1 but these may be changed for much larger units if load conditions demand it. The small house of which the roof is visible in the corner of the inclosure is used to shelter a distribution panel and a street-lighting regulator operated by a time switch. The station shown in Fig. 2 supplies a sanitarium for 200 patients at Rib View. The circuit layout is shown very clearly. The high-tension line, coming in on strain-insulator dead-ends, passes through the air-break switch to the top of the lower structure, where it divides to go through choke coils and fuses to the transformers and through "disconnects" and fuses to the arresters.

Electric Japanning Gives Extreme Satisfaction

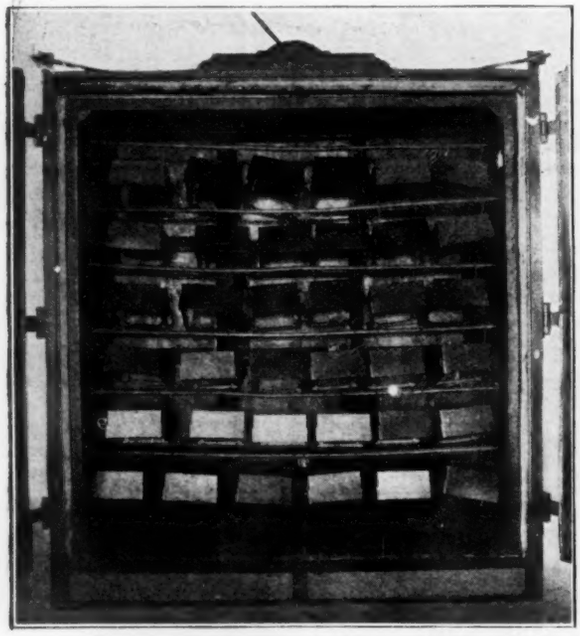
Company Which Started with Gas Kilns Was Pioneer in the Employment of Electric Baking—Construction of Conveying Oven Lately Added—Method of Operating and Comparison with Gas Kiln

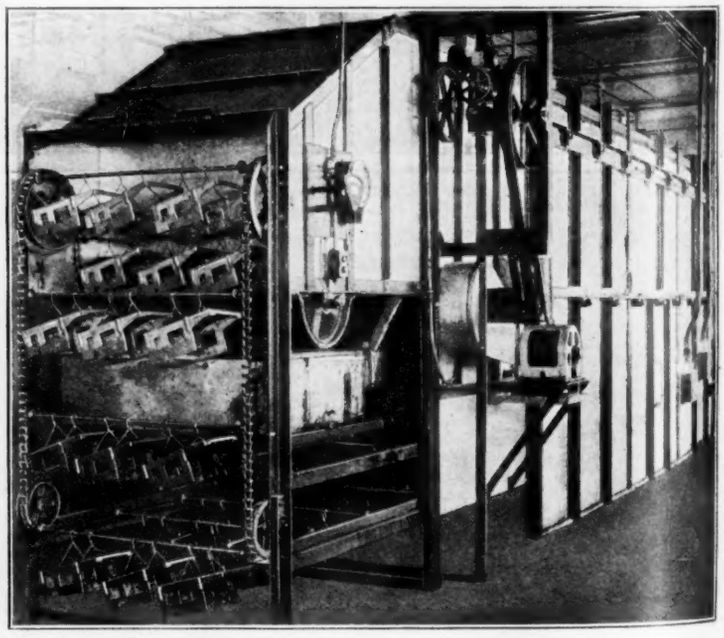
THE Royal Typewriter Company, Inc., which was a pioneer in the application of electricity to baking japan, has had a conveying-type electric baking oven in operation since the end of 1918 which has given extreme satisfaction. While the oven was built and installed as a sort of experiment, it has not only made the process more economical than when gas ovens were used but the product has been of a superior quality. All of the dipped parts used in the typewriters made by this company are baked in this oven. It may be interesting to note that the energy for operating this oven as well as all of that used for other power, lighting and electric heating purposes is obtained from the Hartford Electric Light Company, which instigated the original application of electric heat to these japan ovens and worked in conjunction with the typewriter company to secure the best results therewith.

The oven which is shown in the accompanying illustration was furnished by the Oven Equipment & Manufacturing Company and was electrically equipped with Westinghouse heating elements, motor drive and automatic control. Enough heating elements have been installed to enable the oven to handle 2080 lb. (943 kg.) of typewriter parts per hour, although the present load is half this amount because of the large size of typewriter base. Under existing conditions the average load is 73 kw., so that the daily load is about 730 kw.-hr. based on a ten-hour day.

In general the outfit consists of three main sections—the dipping part, dripping and setting section, and oven proper—measuring about 35 ft. (10.7 m.) long, 5½ ft. (16.8 m.) wide by 10½ ft. (3.2 m.) high over all. It loads and unloads at one end, requiring the services of four persons—one to load, one to unload, one to wipe drips and blow out occasionally and one to rack the parts that are japanned. Two endless chains carrying eighty-one cross-bars pass in a wave-shape path through the outfit. On each of these cross-bars three typewriter bases can be hung. In the first part of the journey through the apparatus the typewriter parts are dipped in a tank of japan kept at about 75 deg. Fahr. (24 deg. C.), where they are immersed for two minutes. After emerging from this bath they pass through a dripping chamber kept at room temperature, taking about twelve minutes for this portion of the journey. Then they enter the oven proper, moving in a wave-shaped path to one end and then returning along the bottom to the front of the apparatus, where they are unloaded and racked. The round trip occupies one hour and fifty-five minutes.

From experience it has been noted that the baking temperature depends on the materials used. The limits of temperature are maintained by an electric contact-making thermostat which actuates type F magnet switches that cut out or cut in two groups of heating elements. Altogether four groups of heating elements containing fifty-two type C oven heaters are used, but the other two groups are connected all the time that the oven is in service. These heaters are connected with four two-wire circuits which have pilot lamps across them to indicate when they are "alive." The elements are arranged along the floor of the oven and are covered with thin sheet iron to pre-





FIGS. 1 AND 2—SECTIONS OF AN ELECTRIC BAKING OVEN, SHOWING ENDLESS-CHAIN CONVEYOR

vent the overheating of parts that pass near them. To keep a check on the temperature maintained a Bristol recording thermometer is provided. If anything goes wrong with the contact-making thermostat, the control apparatus may be actuated by push-button control. The oven proper has a 3-in. (7.6-cm.) lining of heat insulation on the roof and side walls, while the floor and baffles have 2-in. (5-cm.) linings.

Before dipping any metal parts the heaters are energized to bring the oven to a temperature of at least 300 deg. and not more than 400 deg. where it is in use. After the bake the japanned surface is rubbed smooth before the following coats of japan are applied. The finish coat is not applied or baked in this oven, although ultimately some process may be developed whereby sprayed work can be conveyed directly into heated ovens without waiting to fill one up before the heat is turned on.

At present the finish coat is sprayed on with compressed air at 42 lb. (2.9 kg. per sq. in.). The large parts like the typewriter bases are immediately racked in the finishing ovens, but the smaller parts are first racked in portable sheet-metal cabinets to prevent dust accumulating on them after they are sprayed and before they are placed in the ovens. Four to five hours is required to bake the finish coats properly, the time depending on the japan used. For instance, the finishing japans that require 350 deg. are baked four hours, the 385-deg. japans four and one-half hours and the 400-deg. japans five hours.

intense heat will also draw the japan away from the edges of the parts. Another observation which has been made is that the first coats should not be baked so long as subsequent ones because they are rebaked each time another coat is applied.

When questioned regarding the relative values of electric and gas-fired japanning ovens, B. J. Dowd, factory superintendent, said that the electrical method is immensely superior in numerous ways. Having started with gas kilns and worked through to the electric conveying oven, Mr. Dowd should be in a position to speak authoritatively. Among the advantages he named were superior quality of product, more baking capacity per unit of factory space occupied by ovens, and reduced cost of operation. The last advantage is interesting in view of the fact that some persons think that electric heat is expensive. In this process, as in other applications of electric heat, the factors that reduce the over-all cost and make electrical operation preferable are the higher efficiency of operation, reduced attention necessary, smaller space required, reduced labor, accuracy of control that permits uniformity of product, absence of contaminating gases and soot, elimination of fire hazard, etc.

With the old gas-fired furnaces there was always need of the closest attention to prevent the gas flames giving off soot that would deaden the luster of the japan. Besides, there was danger of overbaking pieces in the lower part of the kilns next the flames. Sometimes the dripping

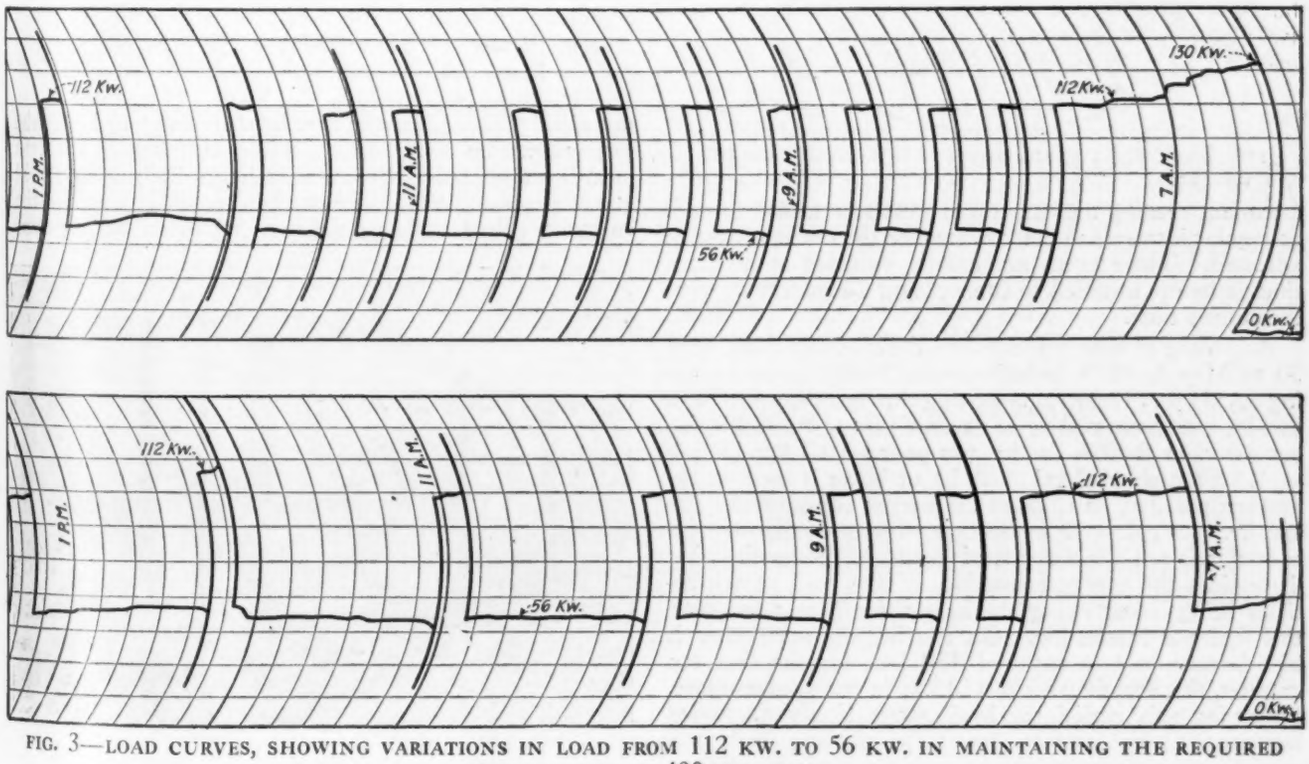


FIG. 3—LOAD CURVES, SHOWING VARIATIONS IN LOAD FROM 112 KW. TO 56 KW. IN MAINTAINING THE REQUIRED TEMPERATURE OF 400 DEG. FAHR.

With both types of ovens dampers in the top are left open during the first hour of each bake to permit the escape of fumes from the japan. After that period they are closed. It has been found that if the temperatures are lower than the proper figure the japan will be too soft when baked, whereas too high a temperature will blister the japan, make it brittle and take out its "life." Too

japan would catch fire and ruin the entire contents of an oven or even become explosive in character, endangering the building. This condition no longer exists. Furthermore, the automatic control permits duplicating results day in and day out.

The finishing ovens, of which there are five, were installed years ago and were described in 1914 before the

American Institute of Electrical Engineers by M. H. Flynn, who was than superintendent of the Royal Typewriter Company. They also were furnished by the Oven Equipment & Manufacturing Company. They have heating grids arranged on the floor next to the side walls. Angle-iron slides are attached to the side walls, between which racks may be placed to hold parts to be baked. No automatic control has been installed for these ovens, an

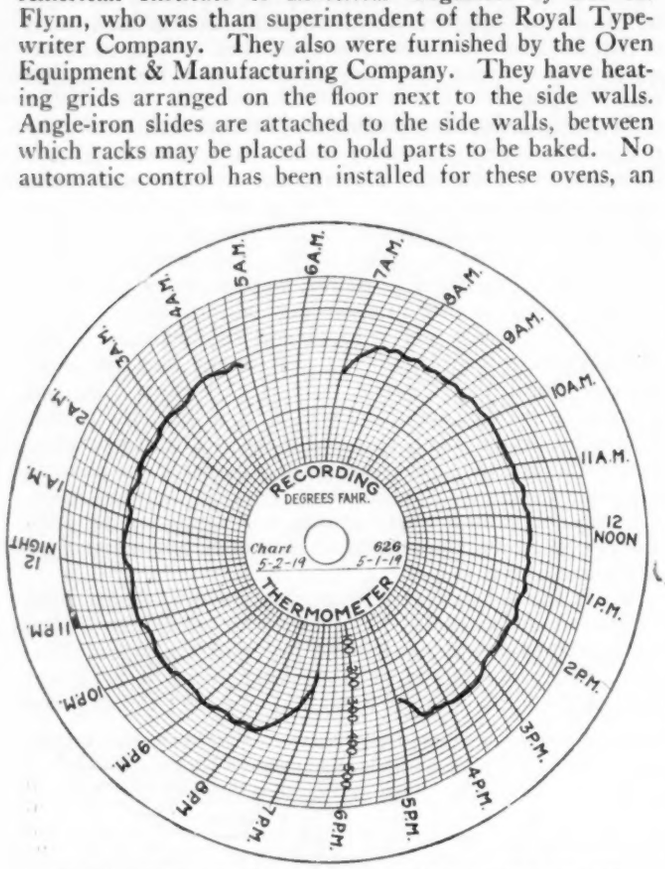


FIG. 4—TWENTY-FOUR-HOUR TEMPERATURE CHART

attendant reading mercury thermometers attached to each at regular intervals to determine when the current must be adjusted. These ovens are usually operated at night; a time switch is installed to connect and disconnect them at the desired time.

According to tests conducted on the conveyor oven April 30 to May 5, 1919, inclusive, with 16,884 pieces weighing 33,331 lb. (15,100 kg.) passing through the oven, 3036 kw.-hr. was consumed at an average rate of 0.192 kw.-hr. per piece, or 0.0994 kw.-hr. per pound (0.2 kw.-hr. per kg.). Since about 2 gal. (7.6 l.) of japan is used on the average per day, this makes the energy consumption 304 kw.-hr. per gal. (80 kw.-hr. per liter) of japan. Of course it is not the amount of japan that is applied that determines the energy consumption (the mass of the articles being baked fixing the heat absorption); however, this figure is interesting. On starting the oven after it had become cold it required 130 kw. for the first ten minutes, this dropping off to 112 kw. in ten mintues more. Following this period the load automatically fluctuated between 112 kw. and 56 kw. The running loads permitted by the arrangement and connection of resistors are 112, 80, 56 and 24 kw. respectively.

After a shut-down it requires about one hour to raise the temperature of the oven to the baking temperature. This involves an energy consumption of about 100 kw.-hr., which would be saved if the oven were operated continuously. Furthermore, any schedule of operation which would reduce the number of shut-downs would effect a saving of approximately 100 kw.-hr. per shut-down.

The peak load of 130 kw. is partly due to voltage and partly to cold resistor units. During the test mentioned the load automatically dropped to 56 kw. after the oven became heated to a certain temperature and remained at this load about ten minutes. Then the load rose to 112 kw., remaining at this figure for a little more than five minutes. This sequence of operations continued throughout the day, the loads dropping to 56 kw. about fifteen times a day and remaining at that figure for a period of variable length, the time being increased from ten minutes' duration in the morning to about forty minutes or more in the afternoon.

Owing to the blowing of a fuse or some other cause during the test, the intermittent load period increased to ten, twenty and thirty minutes. This points a way to a possible improvement in the operation. Because of the different pieces of work which must be baked in the oven and other factors it is obviously impracticable to operate the oven at a constant load. However, it is desirable for many reasons that the intermittent portion of the load should be as small a percentage of the maximum as is consistent with satisfactory temperature control. The continuous portion can be made so small that the intermittent portion will be practically on all the time or can be made so large that the intermittent portion will be on hardly at all. For each class of work that the oven performs it is apparent that a certain ratio of intermittent to maximum load will therefore give the least fluctuation. For such operation as occurred between April 29 and May 6 the fluctuation should be greatly reduced by increasing the continuous portion of the load and decreasing its intermittent portion. Thus on May 1 the total consumption for ten hours and ten minutes' operation was about 749 kw.-hr., or an average load of 75 kw. It is necessary to use about 130 kw. for the first hour in order to bring the temperature up to the desired value, although in case the oven were operating twenty-four hours daily this would not be necessary, as pointed out before. Allowing for the energy required to bring the oven up to its baking tem-

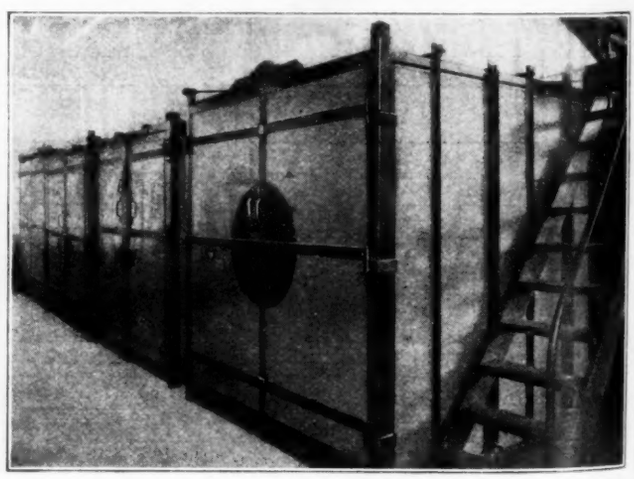


FIG. 5—EXTERIOR VIEW OF OVENS

perature, the average load for the rest of the day was approximately 69 kw. If this were to be divided into a continuous load of 65 kw. and an intermittent load of about 10 kw., it would result in improved operating conditions.

As the resistance seems to be divided into four approximately equal parts, each taking about 28 kw., it seems that

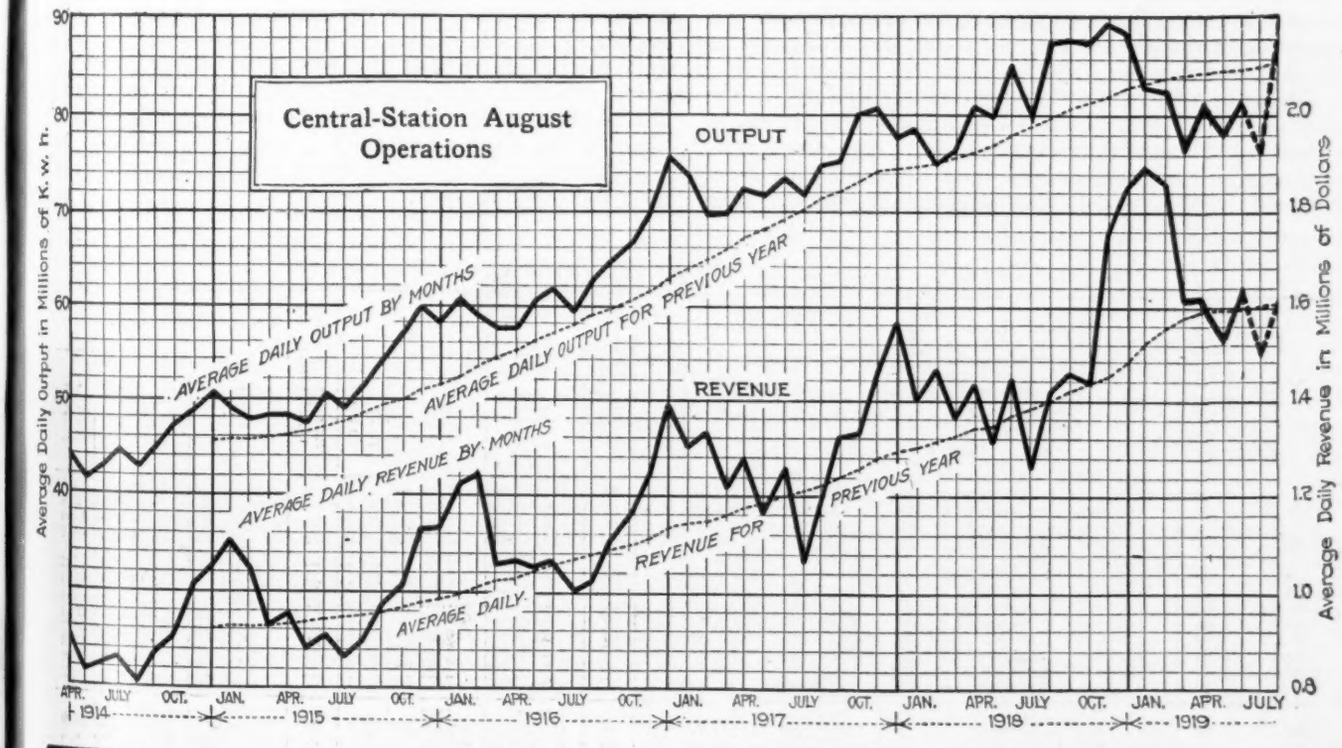
a better operating condition would result if the arrangement could be changed so that the intermittent load would be 28 kw. If the class of oven work be changed the continuous load should be changed, still keeping 28 kw. for the intermittent load. While the foregoing figures apply for the data presented in the accompanying table, the energy consumption over the test period mentioned was less than shown there because 20,592 pieces, weighing 43,367 lb., were baked with an energy consumption of 3843 kw.-hr., making the consumption per piece 0.1866 kw.-hr. and the consumption per pound 0.886 kw.-hr. The variation in consumption per piece and per pound seems to be very wide from the average, but an inspection of the table will show at once the reduction in energy per piece and increase in energy per pound with reduction in weight of pieces.

Regarding the possibility of twenty-four-hour operation, it may be pointed out that at the present time the final coats of enamel are applied with a spraying process to which the continuous conveyor oven is not adapted so these last coats are baked in the electric ovens formerly used. Furthermore, the circuits feeding the old ovens and the new continuous conveyor oven are arranged so that both sets cannot be used at the same time. It may be advisable in the future to look into the possibility of adapting a continuous conveyor oven to the spraying process. To decrease the load fluctuations on the oven an induction regulator or a variable-ratio auto transformer may be employed to advantage. It is expected that the new oven will pay for itself in three years.

DATA ON FIVE DAYS' OPERATION

Date	Kw.-Hr.	Pieces	Pounds	Kw.-Hr. per Piece	Kw.-Hr. per Lb.
April 30	330	3,037	2,862	0.109	0.115
May 1	749	2,857	8,471	0.262	0.088
May 2	694	2,767	7,628	0.251	0.091
May 3	735	3,103	10,421	0.237	0.071
May 5	528	5,118	3,959	0.103	0.133
Total for five days	3036	16,882	33,341	(Ave.) 0.192	0.0994

Output Continues to Increase



THE usual seasonal increase in electrical output is apparent in the returns of central-station operations received by the ELECTRICAL WORLD for the month of August. The percentage of increase over August of 1918 is, however, slightly below what it has been for many months. The returns indicate a constant increase of electrical output for the whole country since the month of March. Previously August of last year was the first month in electrical output, and the fact that this record is now exceeded is significant.

A normal yearly increase of 13.5 per cent in central-station revenues is exhibited. While this percentage in revenues is the lowest since October of last year, yet it follows closely the upward curve which has been maintained since March of this year. The revenues for August are the largest since March and are in excess of September and October of last year.

According to the returns from various localities, the Pacific and Mountain States showed a considerable decrease in output. The largest decrease in this section is noticeable in the copper regions where the metal output had fallen to 60 per cent of capacity, while in California, where there has been continued activity in oil well development, there was a slight increase in output. The

Central States showed striking gains in output during August, the returns being the largest since January. This increased output in the mid-continental states about balances the losses in other sections of the country and makes the total amount of electrical energy output about the same as last year. It is not known to what extent the increase in this section was due to the continued feverish activity in the oil fields, particularly in Texas, but utilities operating in these sections returned very favorable reports for August.

Demands for power service were unusually large in the steel and coal regions of the Atlantic States, and the power output is the largest since August of last year. Companies operating in the more important textile centers of New England reported satisfactory increases in output. The total output of New England is slightly lower than July, yet the output for August is about 30,000,000 kw. greater than the aggregate amount recorded for the month of September of last year.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1918	1917	Per Cent Increase	1918	1917	Per Cent Increase
Sept.	60	$28,051,000	$23,810,000	17.8	1,579,149,000	1,348,820,000	17.0
Oct.	56	26,254,000	23,228,000	13.0	1,517,866,000	1,392,359,000	9.0
Nov.	57	29,883,000	25,894,000	15.4	1,528,836,000	1,383,747,000	10.5
Dec.	56	32,058,000	27,128,000	18.1	1,539,161,000	1,369,542,000	12.3
		1919	1918		1919	1918	
Jan.	57	33,294,000	27,589,000	20.6	1,522,660,000	1,357,460,000	12.1
Feb.	54	28,130,000	23,162,000	21.4	1,249,806,000	1,157,275,000	7.9
Mar.	57	28,569,000	24,420,000	16.8	1,357,981,000	1,341,374,000	1.2
Apr.	54	27,629,000	23,814,000	15.9	1,278,273,000	1,240,842,000	2.9
May	55	26,389,000	23,023,000	14.6	1,255,598,000	1,267,878,000	—1.0
June	57	28,129,000	24,764,000	13.8	1,397,213,000	1,367,018,000	2.2
July	55	25,489,000	22,331,000	14.2	1,300,568,000	1,275,884,000	1.9
Aug.	55	28,368,000	25,006,000	13.5	1,587,322,000	1,579,214,000	0.5

ELECTRIC VEHICLE BUSINESS DEVELOPING IN NEW ENGLAND

Notwithstanding Difficulties Due to the War, About 112 Passenger and Commercial Vehicles Were Added in Last Year

In spite of the difficulties arising from the war, about 112 electric passenger and commercial vehicles were added to the New England fleets during the past year, stated Day Baker, chairman of the electric vehicle committee of the New England Section of the National Electric Light Association, at the recent New London convention. Upward of 200 industrial electric trucks were installed for service in New England manufacturing plants and shipping terminals during the past year, according to the figures compiled by Mr. Baker.

Plans are afoot for the equipment of a plant in New England for the manufacture of electric vehicles, one of the older and smaller vehicle companies having been taken over by a coterie of New England business men who expect to develop a plant for the construction of electric trucks on a large scale.

During the past year the committee succeeded in convincing the Massachusetts Legislature that electric trucks do not damage roads, with the result that the registration fees for electrically driven trucks and commercial vehicles were placed at one-half the fees charged for gasoline-driven vehicles of corresponding sizes. Electric trucks are also allowed on wharves and docks and in storage warehouses where the gasoline truck is permitted. Within its economic field, the electric truck is rapidly displacing the horse and gasoline truck.

It is authoritatively stated that virtually all the newspapers of Boston and a large share of the wool and cotton transferred in that city are now hauled by heavy-duty electric trucks.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States			Atlantic States			Central States			Pacific and Mountain States		
		Percentage of Industry Represented	1918	1917	Per Cent Increase	Percentage of Industry Represented	1918	1917	Per Cent Increase	Percentage of Industry Represented	1918	1917	Per Cent Increase	Percentage of Industry Represented	1918	1917	Per Cent Increase
REVENUE	Sept.	64	$3,268,000	$2,811,000	16.2	57	$10,143,000	$8,631,000	17.5	51	$9,251,000	$7,703,000	20.1	86	$5,389,000	$4,665,000	15.5
	Oct.	63	3,360,000	3,036,000	10.6	51	8,822,000	7,924,000	11.3	50	9,218,000	7,848,000	17.4	81	4,854,000	4,420,000	9.8
	Nov.	64	3,695,000	3,238,000	14.1	55	11,877,000	10,400,000	14.2	50	9,277,000	7,704,000	20.4	81	5,034,000	4,552,000	10.6
	Dec.	64	4,097,000	3,449,000	18.7	55	11,927,000	10,199,000	16.9	50	10,781 000	8,836,000	22.0	79	5,253,000	4,644,000	13.1
			1919	1918			1919	1918			1919	1918			1919	1918	
	Jan.	63	4,253,000	3,443,000	23.5	60	13,444,000	11,168,000	20.3	47	10,410,000	8,484,000	22.7	77	5,187,000	4,494,000	15.4
	Feb.	63	3,895,000	3,048,000	27.7	53	10,894,000	8,943,000	21.8	45	9,305,000	7,484,000	24.3	73	4,036,000	3,618,000	11.5
	March	64	3,608,000	3,044,000	18.4	58	11,731,000	10,244,000	14.5	47	9,012,000	7,447,000	21.0	81	4,218,000	3,685,000	14.4
	April	64	3,473,000	2,964,000	17.2	51	11,408,000	10,114,000	12.7	47	8,420,000	6,981,000	20.5	76	4,328,000	3,755,000	15.3
	May	62	3,194,000	2,800,000	14.0	51	9,430,000	8,571,000	10.0	47	8,297,000	6,888,000	20.4	77	5,468,000	4,764,000	14.7
	June	64	3,321,000	2,925,000	13.3	55	10,535,000	9,478,000	11.2	50	8,857,000	7,500,000	16.7	78	5,516,000	4,767,000	15.8
	July	61	3,329,000	2,949,000	13.0	50	9,092,000	8,184,000	11.1	50	8,854,000	7,442,000	19.0	79	4,214,000	3,756,000	12.3
	Aug.	59	3,354,000	2,956,000	13.6	52	10,410,000	9,274,000	12.3	47	9,341,000	7,917,000	18.1	77	5,265,000	4,859,000	8.3
KW.-HR. OUTPUT			1918	1917			1918	1917			1918	1917			1918	1917	
	Sept.	64	133,901,000	114,279,000	17.1	57	520,213,000	445,154,000	16.8	51	471,594,000	408,320,000	15.5	86	453,342,000	381,067,000	18.9
	Oct.	63	139,784000	128,970,000	8.3	51	481,222,000	440,268,000	9.3	50	479,990,000	442,054,000	8.5	81	416,870,000	381,067,000	9.4
	Nov.	64	138,559,000	123,033,000	12.6	55	542,799,000	495,812,000	9.4	50	444,012,000	396,665,000	11.9	81	403,566,000	368,237,000	9.6
	Dec.	64	145,543,000	129,838,000	12.1	55	405,253,000	421,973,000	12.6	50	489,864,000	443,544,000	10.4	79	428,906,000	374,906,000	14.6
			1919	1918			1919	1918			1919	1918			1919	1918	
	Jan.	63	143,254,000	124,632,000	14.9	60	525,322,000	458,545,000	14.5	47	463,394,000	403,127,000	14.9	77	390,690,000	371,156,000	57.2
	Feb.	63	128,660,000	109,993,000	17.0	53	406,702,000	374,958,000	8.4	45	426,965,000	378,992,000	12.6	73	287,479,000	293,492,000	-2.0
	March	64	125,510,000	124,707,000	0.7	58	459,166,000	461,096,000	-0.4	47	442,591,000	423,802,000	4.4	81	330,714,000	331,769,000	-3.0
	April	64	123,211,000	118,322,000	4.1	51	382,282,000	369,701,000	3.4	47	373,116,000	345,213,000	8.1	76	328,925,000	333,405,000	-1.0
	May	62	120,949,000	122,531,000	-1.3	51	362,207,000	383,860,000	-5.6	47	389,805,000	375,944,000	3.6	77	382,637,000	385,543,000	-0.7
	June	64	127,355,000	119,946,000	6.3	55	406,102,000	417,441,000	-2.7	50	417,942,000	386,422,000	8.4	78	445,814,000	443,209,000	0.6
	July	61	139,133,000	129,639,000	7.4	50	366,790,000	372,817,000	-1.6	50	428,370,000	408,165,000	5.0	79	366,275,000	365,263,000	0.3
	Aug.	59	138,362,000	133,369,000	3.8	52	547,896,000	558,826,000	-2.0	47	461,769,000	427,449,000	8.3	77	439,295,000	459,570,000	-4.7

HOW PROTECTIVE RELAYS CAN BE MADE SLUGGISH

Four Sets of Conditions That Have a Tendency to Make Relays Slow-Acting in Operating and Releasing

BY H. E. WEIGHTMAN

SLOW-ACTING or sluggish relays are used in protecting circuits for a variety of purposes. Important ones are as follows: (1) To secure a desired sequence of operation when several relays are energized or de-energized at the same time; (2) to insure a fairly definite time interval between the functioning of different parts of a system; (3) to prevent momentary disturbance in one part of a system from affecting some other part. In what follows the writer deals only with the methods used for making relays sluggish in action.

A relay may be made sluggish in one of four ways. The first is to arrange the circuit in such a manner that the current through the winding rises or falls off more slowly than would be the case if no means were taken to affect this time. This is generally accomplished either by placing it in series with external inductance or shunting it with a non-inductive resistance, or both. These are matters of circuit design and do not affect the design of the relay itself except when the non-inductive shunt is wound on the relay and connected permanently to it.

An external inductance slows down the time of operation but not that of release, while a non-inductive shunt slows down the time of release and has little effect on the time of operation. Both effects may be obtained by the use of the two in combination. The effect of any such arrangement is to prolong the time between the closing or opening of the circuit through the winding and the first movement of the armature, and no appreciable effect is produced on the actual speed of movement of the armature. If a relay is shunted by an inductive resistance of higher inductance than its own, it will release more quickly on breaking the circuit, and it is necessary to take this into account when two relays are operated in parallel.

The second method is to design the relay so that the lag between any change in the current through the winding and the corresponding change in the strength of field is greater than the normal. This is accomplished by the use of an additional short-circuited winding. This may be either a regular winding or a single turn of a very low resistance, the latter being the more effective. This single turn takes the form of either a heavy copper head at one end of the spool or a copper tube over the core the full length of the winding space. Tests indicate that the copper head is more effective with tubular-type relays and the tube over the core is more effective with the return pole-piece type. Such an arrangement of the relay results in any change of the field setting up a current in the short-circuited secondary in such a direction as to oppose the change in the field, the effect of which is that the field changes more slowly than the current in the operating winding. Such a relay may be either slow-operating or slow-releasing, according to the arrangement of the circuit. No matter what the type of the relay for any adjustment, a definite magnetizing force is required to operate it, and when it is operated the magnetizing force must be reduced to a definite amount to allow it to release. The magnetizing force actually applied depends on the product of the number of turns in the winding and current passing through it, which may be expressed as ampere turns. If the winding and the operating ampere-turn requirements are so chosen that the relay receives barely enough current in the circuit in which it is to operate, the field will not become strong enough to move the armature when the circuit is closed until the effect of the short circuited secondary has been overcome and the field has reached its full strength. The relay will accordingly be slow in operation. A relay under such circuit conditions can be made to release comparatively quickly by choosing such a design that the releasing requirement is high in proportion to the operating requirements.

To insure slow releasing the winding and operating requirement must be so chosen that the final value of the magnetizing force produced by the current the relay receives in the circuit is much greater than the releasing requirement. In this case when the circuit is opened the magnetizing force will not decrease enough to allow the release of the armature until the retarding effect of the short-circuited winding has been overcome. A relay under these conditions may be made comparatively quick-operating by choosing a design in which the releasing requirement is low in proportion to the operating requirement. The actual movement of the armature is not retarded in either case, the delay being in the interval between the applying or cutting off the current and the beginning of the armature movement. This construction may be used for making a relay less responsive to alternating current, the copper head or sleeve preventing it from operating it on the peaks, although allowing it to respond to a material increase of current. It should be noted that the inductance of such a relay is very low.

The third method is to make the moving parts of the relay heavy, so that their inertia makes them slow in responding to changes in the magnetizing force. To make the relay slow in operating, the magnetizing force must be just great enough to pull up the armature, and for slow release the restoring force, whether gravity or a spring, must be as small as will give satisfactory service. Either or both of these conditions may be met by suitable mechanical and electrical design. With this construction the actual movement of the armature is retarded. Such a design is used extensively for relays to be operated by alternating current, as the inertia of the moving parts prevents the opening of the contacts during the reversible current. Two windings out of phase may be used; where only a single phase is available a phase-splitting scheme may be employed.

The fourth method is to apply a sheet of non-magnetic conducting material, usually copper, to the face of the armature. Any change in the magnetic field or movement of the armature will set up eddy currents in this sheet. These currents act on the field in such a manner as to produce a force tending to oppose the movement of the armature. The copper sheet thus acts as a sort of electrical dash-pot, serves to retard the movement of the armature and makes it less sensitive.

Two or more of the methods outlined above may be used in the same relay, the first and second being the most common combination. It will be seen from the above that a relay is not generally intrinsically slow-operating or slow-releasing, but that these features are determined by a combination of the design of the relay itself and of the circuit in which it is used.

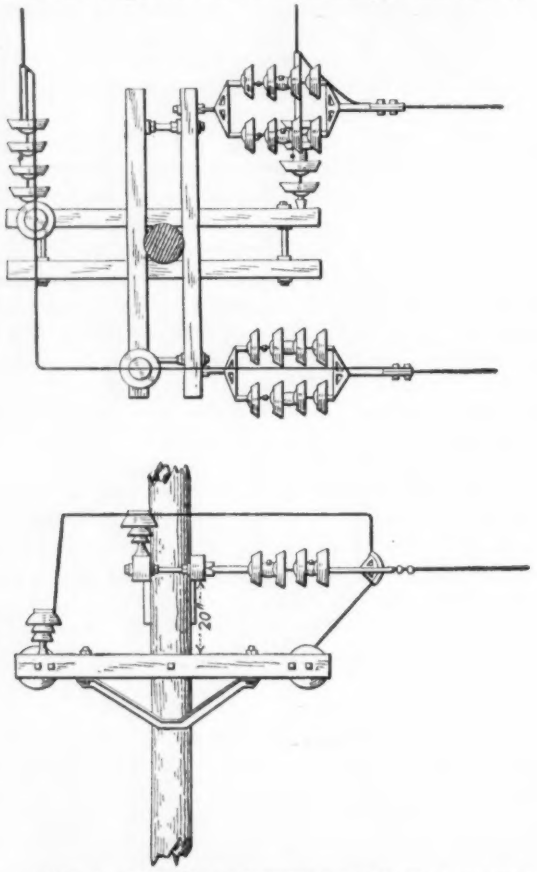
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

COMBINATION CORNER AND CROSSING CONSTRUCTION

Effective Method of Handling High-Tension Circuits Where They Make Right-Angle Turn Adjacent to Railroad Right-of-Way

A type of construction in which there are certain rules to be followed and in which there is yet some latitude for engineering ingenuity is the combination railroad crossing and corner layout. One type of construction for this sort of service is illustrated herewith. It was worked out for 33,000-volt and 13,200-volt lines by the engineers of the Arkansas Light & Power Company, Pine Bluff, Ark.



FIGS. 1 AND 2—CORNER CONSTRUCTION FOR 33,000-VOLT AND 13,200-VOLT LINES

The poles are framed for double buck arms, using one set for the two lower phases and one set for the upper phase. The horizontal spacing between buck arms of the same set is 20 in. (50 cm.) from the top of the bottom arm to the bottom of the top arm. Each wire which crosses the railroad is attached to a double string of disk insulators of Thomas suspension yokes by an Aluminum Company of America strain clamp. Pin-type insulators on the double arms act as supports for the jumper wire and make the job look neat.

Practically the only difference between the 33,000-volt construction and the 13,200-volt construction is in the size of the insulators and in the types of cross-arm braces.

POINTS IN CHARGING OF ALKALI STORAGE BATTERIES

Current Should Preferably Not Be Below Normal to Assure Thorough Deoxidation of Negative Element—Maintenance Simple

Alkali batteries may be charged either in accordance with the constant-current method or the constant-potential method, the latter offering several important advantages. Experience indicates that constant-current rates below normal are not to be recommended because they do not produce a thorough deoxidation of the negative elements, but low charging rates do not in any way affect the life of a cell. The effect of charging with low current is that the discharge voltage is slightly reduced. Charging between the positive and neutral or negative and neutral of a three-wire system is not usually permissible on account of the load unbalance it produces. The pressure is sometimes reduced with resistances, but this method is wasteful if the reduction in potential necessary is great, and it often will be found, especially when a number of vehicle batteries are charged at once, that the installation of a motor-generator or rectifiers results in a marked saving. Of course, if there is not a great difference between the battery and supply pressure, the use of a series resistance may be permissible. For constant-current charging calculations of resistance should be based on 1.55 volts per cell.

When Edison cells are charged by the tapering-current method excessive gassing and evaporation of the electrolyte are avoided, as the current toward the end of the charge is small. Furthermore, if the battery be left connected to the supply for too long a period, the waste involved will be less than would be the case when charging with the normal current all the time. The average current throughout the charge should be equivalent to the normal charging current. This condition can be secured by charging with a pressure equal to 1.7 volts per cell; to compensate for the pressure drop in the charging plug and other electrical connections it may be found necessary to use a pressure equivalent to 1.73 volts per cell.

When charging, the reading of the ampere-hour meter is usually relied upon to show when the cells are charged, but experienced men are also able to gage the time when the current should be cut off by the reading of an ammeter in circuit, because, indirectly, this reading is a measure of the battery voltage.

In making electrolyte for an Edison cell (which consists of 21 per cent solution of potash with a small quan-

tity of lithia) distilled water should always be used. The density of the electrolyte does not change under working conditions, and there is therefore no need to take the specific gravity. All that is necessary in the way of maintenance is to keep the plates covered by the electrolyte by adding a small quantity of distilled water at intervals, depending upon the service conditions and the care that is taken in the direction of cutting off the current as soon as the cells are fully charged, so as to avoid undue evaporation. When the cells have been subjected to about 250 discharges the electrolyte should be renewed, for it then begins to show a loss in strength which in turn results in a reduction in the battery capacity. However, this loss is restored when the electrolyte is renewed.

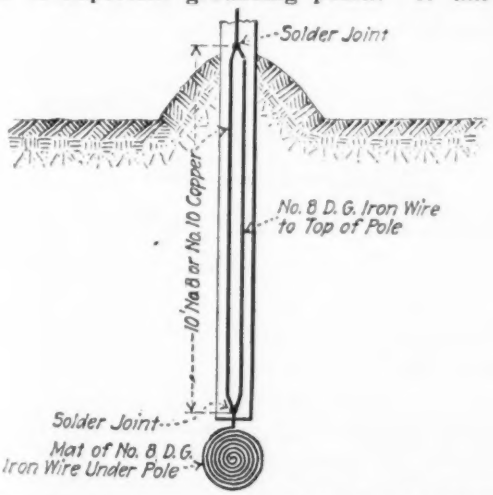
Liverpool, England. MARK MEREDITH.

INSURING PERMANENCY IN GROUND CONNECTIONS

Double Ground Wire at Each Pole Butt and Excavating of Dry, Porous or Gravel Soil Is Considered Worth While

Transmission-line poles of the Arkansas Light & Power Company, Pine Bluff, Ark., are each equipped with a No. 8 double-galvanized wire. This wire runs down from a pole-top bracket and ends in a mat of wire at the bottom. Since such a ground wire will usually fail first at the ground line, owing to the combined action of air and moisture, the Arkansas company reinforces the ground circuit against rust at this point by connecting a 10-ft. (3-m.) piece of No. 8 or No. 10 copper wire in multiple with the galvanized wire. Scrap pieces of copper wire are usually used for this purpose.

The company also believes that the cost of sinking the test holes to study the subsoil under conditions will be justified at important grounding points. If this study



COPPER WIRE CONNECTED IN MULTIPLE WHERE GALVANIZED-IRON GROUND WIRE USUALLY RUSTS THROUGH

indicates that the subsoil is of a dry, porous nature or is composed of gravel, it is considered advantageous to excavate the undersirable soil and to replace it with some moisture-holding substitute that will make and hold a closed contact with the ground terminals. The same result has sometimes been obtained by taking pipe of sufficient length to reach entirely through the undesirable subsoil.

THAWING WATER PIPES WITH ELECTRICAL OUTFIT

Portable Outfit, Including Transformers, Ammeter and Salt-Water Tank for Resistance, Mounted on Truck, Quickly Thaws Frozen Pipes

To thaw frozen water pipes one central station last winter assembled the apparatus shown in the accompanying diagram on a truck so that it might be easily transported to the place of use. The two 50-kw. transformers

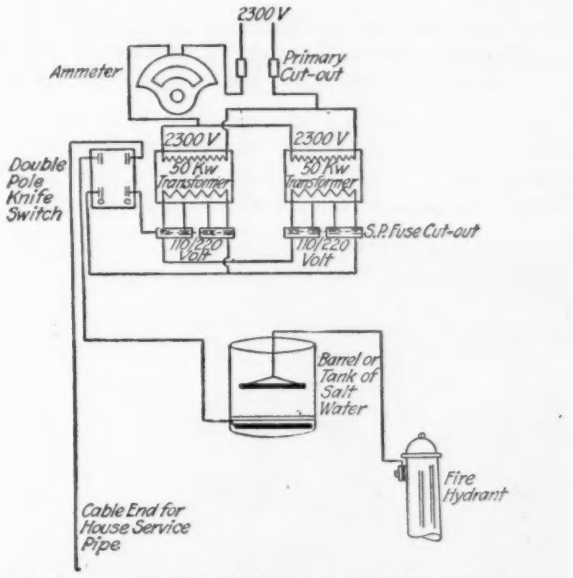


DIAGRAM OF CONNECTIONS FOR THAWING FROZEN WATER PIPES

which were connected in parallel on both sides were joined through an ammeter with the primary line nearest to the house in which the pipe was to be thawed. Then one lead of the transformer secondary was connected to the nearest fire hydrant with the brine tank in series to serve as a resistor and the other attached to a water tap in the house. Variations in amount of current could be made by adjusting the distance between the grids in the brine tank. Primary currents up to 40 amp. were required, the value depending on the size of service pipes to a great extent. This corresponded to about 400 amp. in the secondary

NEW FEEDER LINE PROVIDES NECESSARY EXCESS POWER

Sudden Increase of Power Requirement Necessitates Immediate Construction of a New Feeder to Shop Motor

In order to take care of a sudden increase in the need for cable-carrying capacity, an industrial plant in New England constructed a 200-ft. (60-mm.) combination 200,000-circ. mil and 400,000-circ. mil feeder line from the power plant to the forge shop in a period of a few days.

This line of slow-burning cable was anchored to a steel rail which had been embedded in the brick wall of the shop. The four conductors of the line were carried over the various roofs of the intervening shop and securely anchored at the power house. The line was extended the

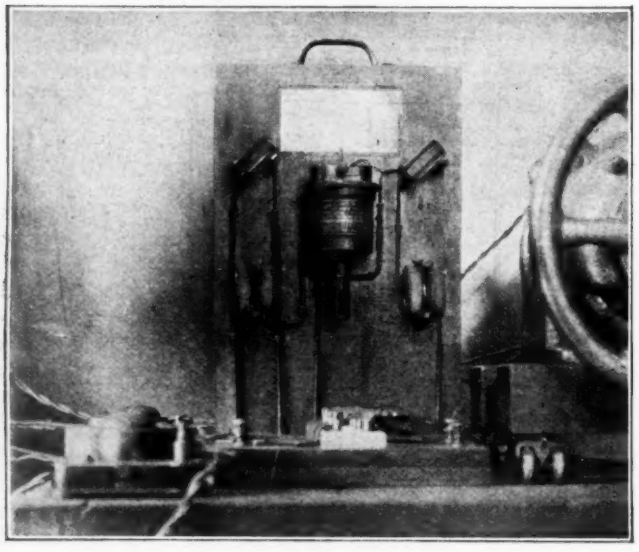
entire length of the forge shop to allow the use of several small motors instead of the 50-hp. motor which had been in use. The increased potential drop on account of this longer feeder was only two volts at full load and the extra copper cost $400, but the value of this action justified the expense. H. S. Rich.

East Berlin, N. H.

BOARD FOR THE TESTING OF CURRENT TRANSFORMERS

Any Combination of Standard Instrument Coils Put in Series with Current Transformer Under Test by Operating Four Knife Switches

In order to provide certain fixed loads as a uniform basis for comparison of various current transformers when testing them for ratio and phase angle, a time-saving "load board" has been devised by the testing department of the



STANDARD INSTRUMENT COILS MOUNTED ON TESTING BOARD

Commonwealth Edison Company, Chicago. On this board are mounted standard instrument coils as follows: Two ammeter coils, one wattmeter coil, one power-factor-indicator coil and one overload relay coil. A table is posted at the top of the board showing the correct position of the switches for any practicable combination of loads that may be put in series with the transformer. Each combination of instruments represents a load of so many volt-amperes at a certain power factor . For convenience these different loads are called by numbers, as No. 1, No. 2, etc. A portable ammeter may be connected to binding posts on the board for a rough adjustment of the current. This ammeter may be shunted out by one of the knife switches when desired.

POSITION OF SWITCHES AND RELAY PLUNGERS

Load No.	Position of Switches	Position of Relay Plunger	Volt-Amperes
0	All closed	.....	4
1	No. 1 open	.....	10
2	Nos. 1 and 2 open	Lower position	25
3	Nos. 1, 2 and 3 open	Upper position	40

COST OF INSTALLATION OF STATIC CONDENSERS

Value of Transmission and Conversion Facilities Recovered Plus Losses Eliminated Shows Net Annual Saving of $2,812.50

Data on the saving which is made possible by the installation of a static condenser were given in a paper by R. H. Carlton, Schenectady, N. Y., before the Indiana Electric Light Association recently. A summary of the results obtained after a 400-kva. static condenser was placed in service is given below as taken from this paper.

POWER FACTOR RAISED FROM 70 TO 90 PER CENT.

Cost of 400-kva. static condenser	$7,200.00	
Expense of transportation and installtaion	300.00	
Cost of set installed		$7,500.00
Annual fixed cost, 15 per cent		1,125.00
INCREASED RATING MADE AVAILABLE, 300 KVA.		
Value of rating, 300 kva., at $50 per kw		15,000.00
($50 per kw. taken as the cost of transmission and conversion investment.)		
Annual fixed cost, 15 per cent	$2,250.00	
REDUCTION IN LOSSES, 225,000 KW.-HR.		
225,000 kw.-hr. at $0.0075 per kw.-hr	$1,687.50	
Annual saving		$3,937.50
Annual cost		1,125.00
Net annual saving		$2,812.50

In addition to having the advantage of effecting a financial saving, this device is also simple in operation and requires no attendance unless it is to be cut out of the circuit during periods of light load. In such a case this operation may be accomplished by an ordinary time switch. Any foundation which will support the weight of the outfit is satisfactory. It may be installed at the very source of the reactive load and will therefore correct the wattless current all the way back to the generator. Its high efficiency, which is better than 99 per cent in all sizes for direct application, gives good operating economy. Each condensing unit has its individual fuse and each phase has its effective reactance and discharge resistance, the former to protect the units from disturbances due to high harmonics and the latter to remove from the condenser any charge when the equipment is disconnected.

LINEMEN NOT OPPOSED TO WORK ON LIVE LINES

Prefer to Work on Them with Proper Safeguards Rather than Take a Chance that Lines Supposed to Be Dead Will Become Energized

In a paper presented before the Michigan Section of the National Electric Light Association recently, H. J. Burton of the Consumers' Power Company, Jackson, Mich., asserted that the linemen of his company who had practiced changing insulators with the lines alive and also with the lines dead would rather work on live lines with proper protection than on dead lines without protection. These linemen consider the dangers incident to the accidental energizing of the line supposed to be dead as greater than the hazards of working on live lines with the proper insulating appliances. Moreover, emergency or rush work, which always adds to the hazard, is to some extent avoided, and the work can generally be done in the daytime when the light is good.

In doing such work the foremen of the company are instructed regarding special precautions to be observed. Noise and static on telephone lines, discharging lightning arresters or an unusual amount of static on or around lines and insulators indicates trouble, which may be due to defective insulators or to an "arcing ground" on the high-tension lines. Foremen instruct their men to work with extreme caution at such times. It is generally advisable, however, to stop the regular work of changing insulators until the cause of the trouble has been found. This precaution, it is maintained, should always be heeded on systems with a grounded neutral.

Before any work on high-tension lines is undertaken for the first time a careful analysis is made of the job. Each operation is considered, and the men are selected and trained for the different operations which they are to perform.

AUTOMATIC TEST BOARD FOR ALTERNATING-CURRENT METERS

One Meter Can Be Warmed While Another One Is Undergoing Test—Hand-Operated Attachment Is Used to Make Connections

A practically automatic meter-test board which has been perfected by F. C. Hahn of the Washington Water Power Company, Spokane, Wash., is shown in the accompanying illustration. The board holds two meters, one of

TESTING BOARD THAT IS PRACTICALLY AUTOMATIC

which is being warmed while the other is being tested. The meter is hung on a hook and a button is pushed which energizes five solenoids. These operate as many arms with finger contacts, which engage the five terminals of the meter. To change the connections for two-wire and three-wire meters a switch is used, thereby making no change in the operation of the finger contacts.

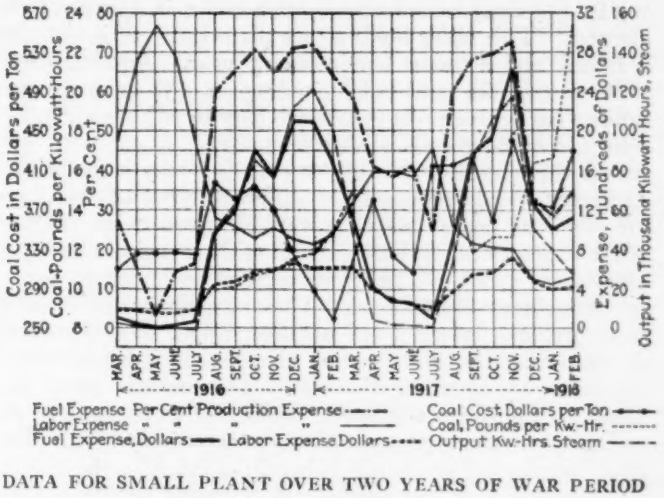
For testing high-torque induction meters which have their terminals brought out at the bottom of the meter, a special hand-operated attachment is used to make connections to the board. They are made in one movement. In addition, the old method is retained of connecting meters with lead fitted with terminals which go into meter binding posts. They snap back into place when released.

The load used for testing meters is operated by a keyboard similar to that of an adding machine. Each key operates a relay which makes connection with the load. In addition, each relay performs three separate functions: (1) loads the meter under test; (2) loads the meter warming up, and (3) loads the standard to bring it to zero. A separate key is used to bring the standard to zero and to disconnect the load.

PLANT EXPENSE VARIATIONS OVER A TWO-YEAR PERIOD

Curves Giving Operating Data for Plant from March 1916 to February 1918 Show Effect of Seasonal and War Conditions

Before the war, when there were no abnormal changes in the price of fuel and labor, operators of power plants were able to determine with fair accuracy the performance of a certain plant based on previous experience. However, in the last few years so many variables have entered into the calculations that the results obtained are practically useless for estimating or comparison purposes. This is visually shown in the chart here produced, which contains curves for a small plant from March, 1916, to February, 1918. The output in kilowatt-hours during this period


Coal Cost in Dollars per Ton
Coal-Pounds per Kilowatt-Hours
Per Cent
Expense, Hundreds of Dollars
Output in Thousand Kilowatt Hours, Steam
MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB.
1916
1917
1918
Fuel Expense Per Cent Production Expense
Labor Expense " " " "
Fuel Expense, Dollars
Labor Expense Dollars
Coal Cost Dollars per Ton
Coal, Pounds per Kw.-Hr.
Output Kw-Hrs. Steam

DATA FOR SMALL PLANT OVER TWO YEARS OF WAR PERIOD

is about what is expected—high in the winter months and low in summer. On the other hand, the coal used in pounds per kilowatt-hour varies considerably. In August, 1916, it amounts to only 10, whereas in February, 1918, the value is 23. This may be accounted for, however, by the fact that the coal used toward the end was not so good as what was used formerly. The fuel expense became a greater proportion of the total production expense as the production increased, and vice versa.

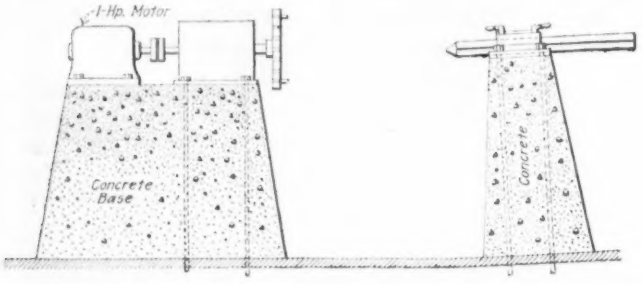
INDUSTRIAL APPLICATIONS

The Economical Utilization of Electrical Energy in Mills and Factories. Together with Practical Details of Installation, Control Testing and Repair of Equipment Required

DEVICE FOR REWINDING NEW-TYPE TRANSFORMERS

A Coil Winder That Can Be Used for Many Types of Coils and Solves Problem of Winding Transformers Not Often Rewound

For rewinding transformers and for winding coils of all kinds the testing department of the Sanitary District of Chicago has built a coil winder which has a wide range of usefulness. A shown in the accompanying diagrams, the winder is mounted on a concrete base consisting of a pillar 4.5 ft. (1.4 m.) long and 4 ft. (1.2 m.) high and



MOTOR-DRIVEN DEVICE ON WHICH COILS CAN BE WOUND DIRECTLY ON A TRANSFORMER CORE

2.5 ft. (75 cm.) wide at the bottom and 2 ft. (60 cm.) at the top. This pillar holds a face plate (such as is used in a lathe) and a motor and reducing gear. Another concrete post of the same height and 15 in. (38 cm.) square holds a bar with a pivot end which may be adjusted lengthwise for holding coils of different sizes. About 3 ft. (1 m.) is the length of the longest coil that may be handled. Different speeds required for different types of winding are obtained by means of a variable-speed 1-hp. single-phase series motor in combination with a variable voltage auto-transformer. The transformers and motors were purchased together as a set. The transformer has twelve taps, giving a motor speed of 1800 r.p.m. to 600 r.p.m. A standard 1-hp. gear reducer changes the speed at 1800 r.p.m. to 49 r.p.m. at the coil. This gives a speed of about 16 r.p.m. for the lowest tap of the transformer. A coil speed of about 30 r.p.m. is most commonly used. To allow freedom of the hands in handling the wire the motor is controlled by a foot switch. A reversing switch is also installed on the concrete base.

When the type of transformer will permit the core is clamped to the face plate and the wire is wound directly on the core. For winding the coils separately a frame of 1-in. (25-mm.) angle iron is used. Four pieces of this iron are held in place around wooden blocks. The blocks may be adjusted for winding coils of different sizes. In front of the coil and parallel to the axis of rotation runs a 0.5-in. (12-mm.) steel rod which supports a sliding guide through which the wire is fed. This facilitates even winding. Mounted on the frame is a revolution counter which is operated by a finger on the face plate.

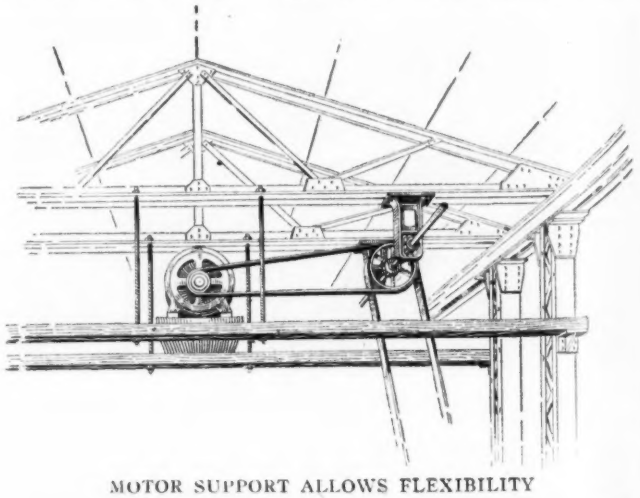
Used in conjunction with the winder is the stand for holding the spools of wire. This stand is of 2-in. (5-cm.) angle iron held together with ¾-in. (19-mm.) rods. It is 4.5 ft. (1.3 m.) high, 1.5 ft. (45 cm.) wide and 2.5 ft. (75 cm.) long. It has rods to support four reels. Mounted at the front of this frame is the device for putting tension on the wire. This is a small iron frame about 5 in. by 5 in. (12.5 cm. by 12.5 cm.) by 1 in. (2.5 cm.) which holds seven strips of hard maple wood each about 1 in. (2.5 cm.) wide, 5 in. (13 mm.) thick and 4 in. (10 cm.) long. These are held together with more or less pressure by bolts. The wire is run lengthwise between these blocks, and the pressure applied on the blocks determine the tightness of the winding. As many as six wires may be run at the same time. In this case the reels are placed back of the stand and the wires are run through it.

With this winder transformers and coils of all kinds are wound. Even the new type of small transformer may be rewound, leaving plenty of room for insulation. The largest wire wound with this device was put on a 50-kw., 2200/110/220-volt transformer when three wires 0.18 in. (45 mm.) square were applied at the same time.

F. DE MUTH,
Chicago, Ill. Testing Engineer Sanitary District.

Motor Support That Was Designed to Facilitate Changes

In equipping a machine shop of the Standard Stoker Company of Erie, Pa., during the war, when speed of installation was of primary importance, the problem had



MOTOR SUPPORT ALLOWS FLEXIBILITY

to be solved of mounting the motors so that they could be easily changed to meet varying conditions. The high slanting roof of the building precluded its serving as a

support, and the structural steel roof supports were not in such a position as to give a convenient footing for the motors if they were directly mounted. The problem was effectively solved, however, by supporting two 4-in. by 6-in. (10-cm. by 15-cm.) wooden beams on angles attached to structural-steel columns at each side of the bay. A wooden platform was then placed on the wooden beams in a position to be convenient for driving the line shafting. This gave flexibility and allowed the motor mountings to be built while the machines were being installed.

J. E. Wenzel.
Chief Electrician Standard Stoker Company.
Erie, Pa.

RECONNECTING MOTORS FROM 220 TO 440 VOLTS SERIES

Change Made in Connections of Stator Coils of Induction Motors Without Removing the Machines from Their Foundations

In an industrial plant where it was found necessary to operate five 220-volt induction motors on 440 volts a check of the motor name-plates and windings furnished the following rating and winding information: 15 hp., three-phase, 60-cycle, eight poles, fifty-four coils, twenty-four groups, eighteen coils per phase, connected in series-star with six groups of two coils in series per group and two groups of three coils per group. This winding is shown in Fig. 1.

At first it appeared that the motors would have to be rewound for the higher voltage, but upon closer inspection it was discovered that the coils were wound with four wires in parallel with about sixteen turns of four No. 16 double-cotton-covered wires. Two wires were

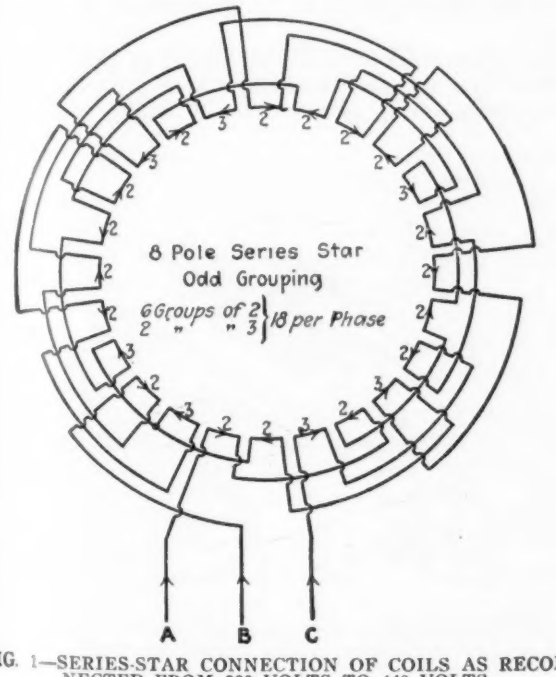
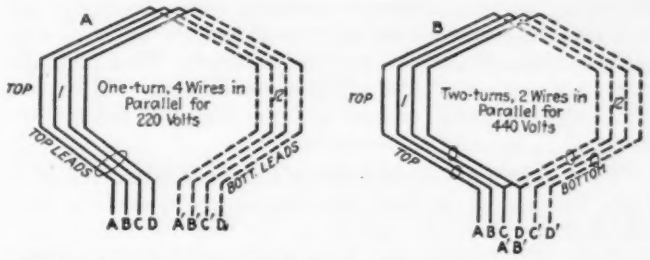


FIG. 1—SERIES-STAR CONNECTION OF COILS AS RECONNECTED FROM 220 VOLTS TO 440 VOLTS

inclosed in one cotton sleeving at the lead end of the coil. The two leads thus wound were all connected together to form a lead of four wires in parallel or eight wires per clip. The reconnection was made as follows: All the connections were unsoldered and removed, including the series connections between coils in the groups. The phase coils were marked with chalk near the iron core. After separating the leads of each individual coil into four sections—that is, into two top leads *AB* and *CD*, shown at



FIGS. 2 AND 3—AT *A* THE COIL AS ORIGINALLY CONNECTED FOR 220 VOLTS IS SHOWN; AT *B* THE SAME COIL IS SHOWN RECONNECTED FOR 440 VOLTS.

In both illustrations one-turn open-end coils are shown for simplicity. The circles indicate the wires inclosed in one sleeve. The coil *A* was wound with sixteen turns of four No. 16 double-cotton-covered wires.

the left in Fig. 2, and two bottom leads *A'B'* and *C'D'*, shown at right in Fig. 2—each section then consisted of two No. 16 double-cotton covered wires in parallel per sleeve.

A test lamp was then rigged up and the coils were tested out by holding one test lead on both wires *A* and *B* (Fig. 2) at once, and the other test lead on both wires *C* and *D;* that is, by testing the two top leads for possible short circuits between the two single coils of sixteen turns of two No. 16 wires. After testing all fifty-four coils in this manner the coils were lighted out for top and bottom leads by holding one test lead on *A* and *B* at once and finding *A'* and *B'* for the bottom lead of the same coil (Fig. 2) with the other test lead. This was repeated on all the coils. Then the top leads *C* and *D* were connected to bottom leads *A* and *B*, as shown on *X* in Fig. 3. This connection formed a coil with twice the number of turns and one-half of the current-carrying capacity, which accomplished the desired result. That is, it made operation possible with double the voltage ($220 \times 2 = 440$ volts) and decreased the ampere rating of the motor approximately one-half.

After all of the fifty-four coils had been connected as indicated at *X* in Fig. 3, the joints were soldered and insulated and the winding connected in series-star, giving the grouping shown in Fig. 1, as originally. The motors thus connected operated satisfactorily on 440 volts.

New York City. C. C. Johnson.

Cutting Out the Stator Coils of Induction Motors

In the article by Ralph McKinney on page 706 in the Sept. 27, 1919, issue of the Electrical World, the reference to 220-volt motors should have been to 2200-volt motors. While 2200-volt motors are mostly series-connected, 220-volt motors usually have parallel connection, hence the statements which were apparently wrong in that article will be correct after the substitution of 2200-volt motors for 220-volt motors has been made by the reader of the article referred to.

SLOTTING BOTH LARGE AND SMALL COMMUTATORS

Center Finder Used for ½-Hp. up to 35-Hp. Motors and End-Milling Cutter for Smaller Motors —Work Done in Lathe

For slotting commutators the Singer Manufacturing Company uses two simple methods—one involving the use of an electric center-finding drill and the other an end mill with simple supports for the armature. Both methods are performed on a lathe. The center-finding drill is used for ½-hp. to 35-hp. motors and the end mill for motors rated at ¼ hp. and less.

To use the first method the armature is supported in a lathe between centers and the electric center-finding drill clamped in the tool post with the tool horizontal and pointing toward the axis of the armature but at an angle therewith so that the tool will not interfere with cutting the slot the full length of the commutator. The armature is held stationary and the center finder is started, fed into the slot to the desired depth and then moved along the lathe longitudinally by means of the carriage feed. Since the drill turns at a high rate of speed the longitudinal movement of the carriage can be fairly rapid. After one slot is cut the armature is turned to bring the next slot into position. While a center-finding drill is used there is no reason why any small drill cannot be used except that it is less rigid. Drills are used having a diameter equal to the width of the slot desired or having a bevel on the end that will provide the desired undercut.

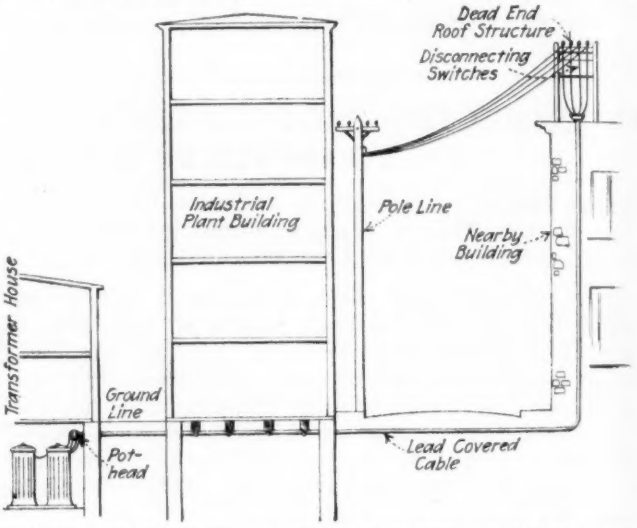
When using the second method the end-milling cutter is fastened in the lathe chuck and the armature held crosswise of the lathe by simple supports bolted to the tool carriage. The supports consist of two pieces of strap iron bent at right angles, with holes in each leg, one to receive the motor shaft and the other to bolt the support to the carriage. With the commutator in place under the milling cutter, the former is fed crosswise of the lathe by the tool feed. It is unnecessary to clamp the armature; in fact, it is sometimes objectionable, because the slots may be askew, in which case the milling cutter is allowed to follow its own course or the armature is slightly twisted as it is being fed.

Bridgeport, Conn. E. S. Smith.

HIGH-TENSION ENTRANCE FOR INDUSTRIAL PLANT

Where Overhead Access Would Necessitate a Costly Structure Dead-Ending the Circuit Permits Putting Wires Underground

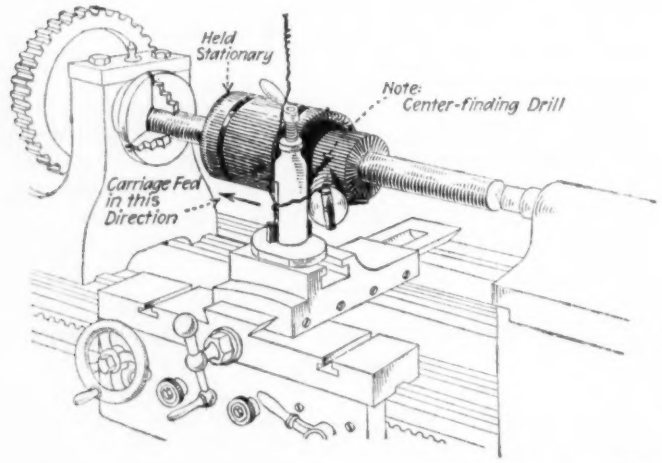
Sometimes a group of industrial-plant buildings are arranged in such a manner that to enter the electrical distribution point from overhead would require a difficult and costly structure. When this difficulty was encountered in supplying a New England plant it was solved by dead-ending the circuit on a building near the pole line, running the wires in a lead cable down the wall of that building and then underground to the underground transformer house.

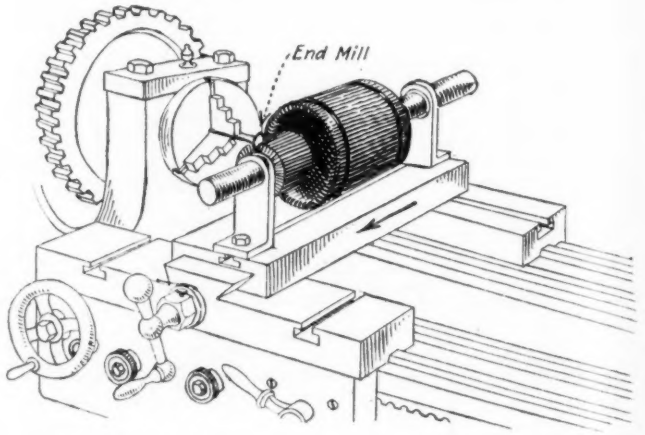


CIRCUIT DEAD-ENDED ON ROOF AND RUN UNDERGROUND TO ENGINE-ROOM

This obviated the possibility of having to change any of the lines in case other buildings were erected. High-tension disconnecting switches were installed on the roof structure so that the transformer room could be cut off when this was rendered necessary in order that repairs to machinery might be made.

East Berlin, Conn. H. S. Rich.





TWO METHODS OF SLOTTING COMMUTATORS

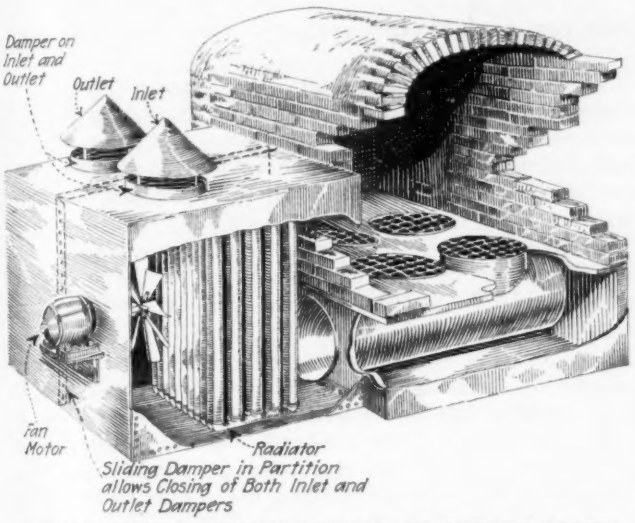
Method of mounting electric center-finding drill to perform this operation on large armatures; special support for small armatures.

OPERATING REQUIREMENTS WHEN BAKING ARMATURES

Characteristics of Varnishes—Methods of Dipping and Baking Coils—Uniform Heat Needed to Insure Best Results

As the result of considerable experience in repairing armatures the writer has arrived at the following conclusions in regard to dipping and baking them:

Insulating varnishes should be clear, oil-proof, acid-proof and waterproof, and should possess good penetrating



AIR IS HEATED BEFORE ENTRANCE TO OVEN IN ORDER TO REMOVE SUSPENDED MOISTURE

qualities. They should be elastic and have good insulating properties. The length of time needed to bake coils and armatures and the degree of temperature depend upon the make of varnish and the oven conditions. The average time of baking is from four to twelve hours, although a longer baking than this will do no harm. The average temperature for baking should be from 180 deg. to 200 deg. Fahr. (80 deg. to 95 deg. C.). Coils before being dipped should be baked in a well-ventilated oven (vacuum drying is a better way) to drive out all moisture. Then while hot they should be dipped in varnish at a specific gravity of 0.815 to 0.890. There are many good varnishes and impregnating compounds on the market, and any one of them may be better for a certain class of work than another. The writer has obtained good results with Ajax insulating varnish, which produces a good finish. Its characteristics are as follows:

The resistance to voltage is 1000 volts to 1200 volts per 0.001 in. (39,400 to 47,200 volts per mm.). It bakes in six to eight hours at 180 deg. to 200 deg. Fahr. (82 to 93 deg. C.) and has a specific gravity of 0.89 to 70 deg. Fahr. (21 deg. C.). A hard surface is obtained only by baking a considerable length of time. Good mechanical strength and a good heat conductance will be obtained after ten to sixteen hours of baking. Two or more dippings are necessary in order to obtain satisfaction. If a long baking process is impossible or if no baking facilities are to be had, other varnishes can be obtained which will bake more or less satisfactorily in less time.

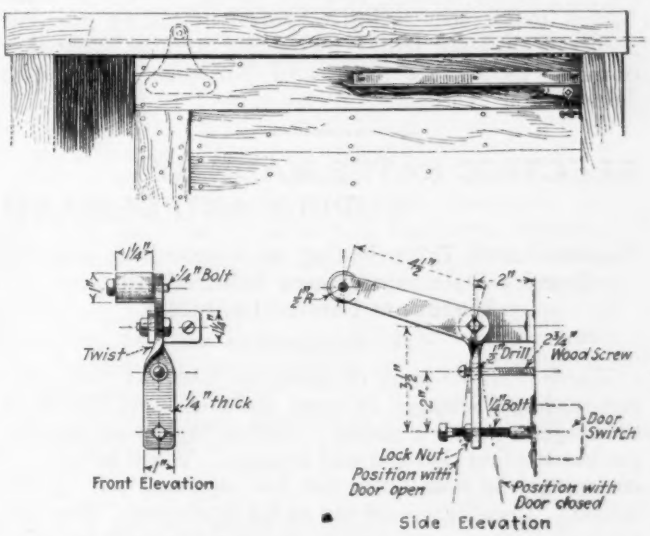
Various forms of ovens can be used; choice depends upon the kind of work to be done. The main necessity where steam is used is to get a uniform dry heat and good ventilation. Care must be taken that joints are tight so that no moisture can get into the oven. When a fresh air inlet is used it should be arranged so that air goes through the heater coils before entering the oven, and there also should be an air outlet to allow gases to escape. If too much air is drawn through the inlet, there will be a considerable heat loss so the opening should be made adjustable in order to control this factor. A graphic pyrometer placed in the oven will indicate temperature and permit satisfactory temperature control.

Bridgeport, Conn. C. A. Aubrey.

SWITCH CONTROLLING LAMP ADAPTED TO SLIDING DOOR

Rocker Arm with Roller on End Actuates Ordinary Swinging-Door Switch and Controls Lamp in Storeroom

In order to be assured that the light in a storeroom of the Lane Manufacturing Company of Montpelier, Vt., is always turned off when the door is closed, an arrangement has been made whereby the lighting circuit is controlled by opening and closing the sliding door. When the door is opened the switch is turned on, and when it is closed the light is cut off. Use is made of a standard automatic door switch by adding the attachment shown in the accompanying illustration. It consists of a bent lever of iron at one end of which is placed a roller made from a piece of old shafting; at the other end holes are made for a bolt and a wooden screw. Near the middle it is drilled to receive a short bolt which serves as a fulcrum. A piece of angle iron is fastened across the door for its entire sliding distance, excepting for a short length



STOREROOM LAMP LIGHTS WHEN ROLLER RUNS OFF ANGLE IRON

of about 3 in. to 5 in. (7.5 cm. to 12.5 cm.) on which the roller bears. While the roller is bearing against the angle iron the door switch is compressed and the lighting circuit open. After the door has been opened far enough, however, to let the roller run off the angle iron the switch closes the circuit.

Montpelier, Vt. Clayton J. Demeritt.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Methods for Increasing the Use of Electric Light, Power and Heat

TRYING TO ENCOURAGE THE ELECTRIC POWER BUSINESS

Power Customers Charged for Only Three-quarters of Summer Demand Provided This Does Not Reduce Demand Below Winter Peak

A modification has been made recently in the demand schedules of one large company in order to encourage power business. Heretofore a power customer that had, for instance, a maximum demand of 1000 kw. in January and 750 kw. demand in July would pay no more than a customer with a demand of 750 kw. in January and 1000 kw. in July. Under the new arrangement the customer with the 1000-kw. demand in summer would only be billed for the 750-kw. winter demand.

The new ruling provides that the maximum demand during November, December, January and February may be increased by 33 1/3 per cent during the remaining eight months of the year without any increase over the demand charge of the four winter months. It the maximum demand during the eight off-peak months is more than 133 1/3 per cent of the winter months' demand, then the customer is billed for 75 per cent of the highest demand obtained during the year.

This means that the customer is billed on a basis of 75 per cent of the demand obtained during the months from March to October inclusive, provided this 25 per cent reduction does not reduce the billing demand below that obtained during the months of November, December, January and February.

ELECTRIC RATES MADE BY SUPPLY AND DEMAND

Economics of Price Fixing as Applied to Electric Service Determine Rates Which Will Give Maximum Service to Public

BY "KASSANDRA"

There is an old story of a butcher who had two signs, one reading "Sausages 25 cents a pound," and the other "Sausages 15 cents a pound." When he had sausages he put out the first sign and sold sausages. When he ran out of sausages he took down the first sign and put up the second. Then he would say to his customers: "Yes, the price of sausage is 15 cents to-day, but I haven't got any. Can I sell you something else?"

The experience of the past few years has been the same, and whenever the price has been fixed too low the result has been that some of those who want the article have to be told: "Yes, the price is low, but there isn't enough to go around, and you must go without."

Fixing prices at a low point is always for the benefit of the man who has money and has been the chief cause of trouble, but when prices have been fixed too high the opposite trouble always occurs and again some one goes without the service until the supply is stimulated to the point where the market breaks.

The price of everything, including electricity, is in the long run fixed by the inexorable laws of supply and demand.

Efforts at price fixing may have a temporary effect. For instance, a price may be fixed too low but will hold until the supply is used up; thereafter the price can be held down only by limiting the amount any one person can have, or it can be held down by subsidizing the producer.

In a like manner, if the price is fixed too high it can be held up only by such means as buying off the producers who would otherwise rush in to take the profits of the high price.

In the case of electric supply this principle is commonly recognized so far as the sale of big power is concerned. If a company rate expert fixes the price for big power in companies either at the costs of a private plant or in comparison with the prices charged by other companies, the only result is that his company doesn't get the business. *Vice versa,* if he fixes the price too low it is only a question of time before the capacity of his plant will be taxed by too much business at too small a margin of profit and, like the butcher, he must say, "Yes, our prices are low, but we haven't any more service for sale."

The fact that any one, including the electric rate experts, can fix prices and hold them for a short time, or sometimes for quite a long time, has led to the belief that prices can be fixed permanently. The successful rate maker does not try to make the rates, but he tries to name rates that shall be as close as possible to the rates that would result from the laws of supply and demand, and, like any merchant, he must watch the market.

The rate maker has not only the opportunity but the duty of estimating the different factors that affect supply and demand. The load factor and the size factor are two of the most important, but the quality of the product, the use to be made of it, the time when it is to be used, are all things which affect the demand and the supply, and by using such items in the rates the rate maker can make his rates approximate more and more closely to the rates which supply and demand in the end control.

In the case of retail lighting and street lighting the same principles control, but when these are but a small portion of the total output it is longer before either the mistake of a too high price has the effect of checking sales and hence reducing the companies' profit, or, on the other hand, a mistake in the way of a too low price has the effect of reducing the profits of the company to such a low point that it cannot make extensions or continue in business. The mills of the gods grind slowly but they grind exceedingly small, as the people who have tried to control street-railway rates are finding out.

The fact that rates are in the end fixed by supply and demand, and not by either the companies' rate experts or by the commissions, does not, however, relieve either of these from their responsibility for mistakes. Both are, or should be, trying to determine the rates which will give the maximum service to the public, and the maximum service to the public means the maximum profit to those who serve the public. Maximum service at the minimum price is obtained from the maximum of ecenomy, and economy, saving and profit are all synonyms.

The point which both the companies' rate experts and the commissions should remember is that in the long run neither of them can fix rates of their own volition. The best they can do is to investigate and determine as closely as possible what would be the rates under free conditions of supply and demand, and so long as the rates are first set at this point and then adjusted as accurately as possible when demand or supply varies, the rate makers or commissions by watching the market of supply and demand will be able to name the rates that give the maximum service at the minimum cost.

INFLUENCE OF WAR ON ISOLATED-PLANT COSTS*

Isolated Plants Which Operated in 1916 at Productive Cost Lower Than Central-Station Rates Now Find Purchased Energy Cheaper

As a guide in directing sales effort for converting manufacturers having isolated plants to the use of central-station power, the Philadelphia Electric Company has made an extensive study of the situation. This study developed the fact that during 1916 it would have been necessary to reduce rates 22.1 per cent to obtain the business of certain factories, whereas in 1918 the rates could have been increased 46.9 per cent. In each of the cases studied there was a definite time when the rapidly advancing isolated-plant costs met the almost stationary central-station rates. This point of contact may be referred to as the critical cost point.

The individual cases by meeting the requirements of a rate form groups around those rates to which they are entitled, and they may be referred to as rate groups. The individual cases of the rate groups do not reach the critical cost point coincidently with other cases within the group, but arrange themselves around another point, establishing sub-groups referred to as year groups. Thus all prospects reaching the critical-cost point during any year, say 1919, would be considered as the 1919 year group.

In order to compare the isolated-plant costs with the central-station rates, an index number is obtained of a certain expense which is the relation which its price at any certain date is to its price at another date. Taking the advance of cost of isolated-plant operation in 1918 over 1916, the following index numbers were obtained for the Philadelphia district:

	Per Cent Increase
Power-plant labor (City of Philadelphia).....126.1	= 26.1
Isolated plant operation labor.....125.2	= 25.2
Coal for isolated plant 178.3	= 78.3
All power-plant costs for isolated-plant operation 157.0	= 57.0

*Excerpt from paper entitled "The Isolated-Plant Costs as Influenced by the War," presented by John W. Meyers before the convention of the Pennsylvania Electric Association, Sept. 3, 1919.

Assuming that the price of purchased energy from January, 1919, to December, 1918, advanced 10 per cent, then the index number of purchased energy will be 110. From these two figures, namely, 157 for isolated-plant operation and 110 for purchased energy, the advantage of the use of central-station power over isolated-plant operation is easily seen.

REGISTERING MAXIMUM DEMAND OF CUSTOMERS

Tests by Georgia Railway & Power Company to Determine Actual Effect of the Varying Maximum-Demand Time Limit

The subject of high-tension service to large consumers was discussed recently by Rawson Collier, operating and sales manager of the Georgia Railway & Power Company, Atlanta, before the sales managers' convention. The larger part of the address was printed in the Electrical World of Sept. 6, 1919, page 518.

In addition to the remarks previously recorded, Mr. Collier spoke of maximum-demand meters, now in favor with many central stations.

"A large number of companies," he said, "now make a rate consisting of a charge per kilowatt of maximum demand plus a charge per kilowatt-hour. To obtain the data for the maximum-demand charge a number of types of instruments are available. Curve-drawing instruments are suitable only for indoors and can be used only where an indoor-type station is used or where the instrument is mounted on the busbars of the customer's switchboard. There are several types of indicating maximum-demand instruments suitable for mounting out of doors in a weatherproof box and connected directly to the watt-hour instrument. These instruments are low in first cost and upkeep and are commercially accurate.

"From time to time a question has been agitated by the customer and by rate experts concerning the effect of the varying lengths of time that should be allowed for registering the maximum demand. To determine the actual effect of the varying maximum-demand time limit tests were made on a number of customers, operating various types of manufacturing plants, the results being based upon observations taken from graphic recording watt charts, comparing the result of the average of four five-minute demands during any four days in the month with one fifteen-minute demand, one thirty-minute and one sixty-minute demand."

The results obtained are given in detail in the following tabulation:

Type of Industry	Number of Customers	15-Minute Demand	30-Minute Demand	60-Minute Demand
		In percent of four 5-minute demands		
Abattoir	2	107	103	99
Barytes and ocher mines	5	101	98.5	86
Bed manufacturer	1	114	111	105
Chair factory	1	107	101.5	97
Cotton mills	4	102	101	99
Cotton linters	1	110	107	100
Fertilizer plants	3	104.2	101.2	93.4
Iron foundries	2	99	95	85.5
Municipal plants	5	107	104.5	100
Oil mills	3	118	110	106
Oil refinery	1	102	100	100
Stone crushing	3	110	104.2	101.5
Average	31	106.8	103.1	98.5

COLUMBUS (OHIO) SYSTEM OF CUSTOMERS' RECORDS

Systematic Care of Orders to Discontinue Service Avoids Trouble with Customers and Gives Exact Record for Easy Reference

For taking care of orders to discontinue service, the Columbus (Ohio) Railway, Power & Light Company uses the accompanying form. There was a great deal of trouble with people who declared that they had ordered service stopped although the company had no evidence of it. This form is filled out and placed in the envelope as soon as the information has been transferred to the form.

The other form shown herewith is the work order for the meter department. Four extra copies of this are made. One copy is sent to the line department so that it may keep posted on what is active or idle, and three copies go to the meter department. When the man pulls the plugs he stamps the cards "account closed," returns one to the new-business department, where it is placed in the envelope for that address, and puts the other two copies in the meter department date file, to be brought up again at the end of ninety days.

Form 247A. 20M Sets. 3-20-15

Date.....

Name .....

Address .....

Business .....

Memo. Order .....

Date..... Signature.....

O. K. and return this order to Contract Desk when completed.

DATE.....

READ AND CLOSE ACCOUNT

NAME .....

ADDRESS .....

MAIL BILLS TO.....

REMARKS .....

.....

.....

.....

SIGNED.....

If the account has not been reopened meantime, the meter is then removed and the date file copies are stamped "meter removed." One copy is sent to the new-business department and placed in the envelope, while the other is kept for the meter department's record. Thus the envelope in the new-business department shows at all times just the state of service at any residence, and a new customer may be told almost exactly how soon he can have energy.

The Shrinkage of the Dollar

Alex. R. Holliday, of Indianapolis, said recently: "In 1914 our medium of exchange was the dollar. In 1919 it has the same name but has really become a dollarette. Compare what these could buy:

The Dollar of 1914		*The Dollarette of* 1919
1.1	Bushels of wheat	0.47
11	Pounds of hog	5
20	Pieces of pie	10
1.3	Tons of Indiana coal at mine	0.05
133	Miles of freight haul commodity rate	80
50	Miles of passenger transportation	35
5	Hours of common labor	2.5

"In general the situation of the electric utilities is that they are paying their bills in dollars and being paid by the public in dollarettes. The cost of operation of individual power plants has more than doubled. Only the prices controlled by legislation which are not respondent to the laws of demand and supply have remained fixed or have been increased by small percentages. If the electrical industry can stand these increased costs without increased revenues, it must have been tremendously profitable in the days before the war. This was not the case. It was a reasonably profitable industry."

ELIMINATING COLLECTION OF SMALL REPAIR BILLS

Indiana Company Charges for Repairs on C. O. D. Basis and Finds That Customers Do Not Object to the Plan

About eighteen months ago, when the Northern Indiana Gas & Electric Company, Hammond, Ind., was endeavoring to cut its operating expenses to the limit, it adopted the scheme of charging for maintenance of gas stoves, gas lamps and other gas appliances on a C.O.D. basis. A list of material used ordinarily for work of this kind was given to the workmen with the prices at which the company desired to sell the material. With a supply of the material the workman was instructed to call on all complainants, estimating the amount of material and labor that would be required and collecting the money before the work was done. He was further instructed, in the event of the complainant refusing to pay cash, to call the office and state the facts in the case before he attempted to do the work. The officials of the company were very much surprised to find how small a percentage of the people refused to pay in advance for this service.

In speaking of the experience J. C. Young, sales manager of the company, stated that he did not recall any serious complications with the customers that had arisen on account of this policy. Through the operation of the plan the company has been able to cut down its bookkeeping expense as well as its collection expense, because it is relieved from the necessity of handling through the books the flood of small accounts ranging from 75 cents to $6. These small accounts used to cost a very large percentage of the total bookkeeping expense.

This work was so successful in the gas business that the company has now adopted the same method for handling

repairs of washing machines, vacuum cleaners, etc. The material which is used in the repairs is sold at list price and the labor charge is based on the amount of time spent on the job. No charge is made for the time going to and coming from the job. The company's hourly charge for labor covers this wasted time.

The men who were to do this work were told that they were to have no arguments with the customers. They were instructed to state that the company was endeavoring to reduce its expenses in handling this class of work to a minimum and that in adopting this method the customer would be relieved of the necessity of coming in at the end of the month to pay a small bill. In the electrical repair work as in the gas department the officials of the company feel that this method has in no way detracted from the good will of the customers. Some feel, in fact, that they have a greater respect for the company because of its more businesslike system.

SALESMANSHIP APPLIED TO ELECTRIC POWER BUSINESS

Power Is a Competitive Commodity Which Should Be Sold on Its Merits by Men Who Are Trained in Selling on That Basis

BY T. O. KENNEDY*

The system on which electric power has generally been sold in the past is almost entirely a matter of bargaining on rates. For instance, assume that the prospective customer is one having an isolated plant which the power salesman is trying to replace with central-station service. The power costs in the isolated plant are arrived at with more or less accuracy, ranging from a guess on the part of the prospective customer to a careful test made by the salesman with the co-operation of the customer. A proposition is then submitted by the power salesman, and the rate finally arrived at depends upon the relative trading abilities of the salesman and the prospective customer. In no case, however, is the purchased power cost as high as the isolated-plant expense.

In my opinion, this method of securing business requires about as much sales ability as selling Liberty bonds at half price, because even the most prejudiced power user can be convinced that where he contracts for central-station service he is getting a great deal more than he can ever get from his own isolated plant.

Electric power is a competitive commodity and as such should be sold on its merits. There is no product that has more "selling points" in its favor or that has more possibilities for development of sales methods, and the power salesman should see to it that his "prospect" realizes the merits of the proposition and, furthermore, that he pays a price somewhere near comparable to the value of the service that he receives.

Briefly, though, the power salesman should lay great stress on the following points:

1. Reliability of service.
2. Availability of increased power capacity to keep pace with growth of customer's business.
3. Relief from supervision of power-plant operations.
4. No real estate or factory space is tied up for power-plant purposes.
5. Capital is released for use in customer's business.

The latter two points are often overlooked by salesmen but are of very great importance. A few years ago the writer was familiar with a steel products concern that, with $250,000 invested in a manufacturing plant, was doing a gross business of this amount every month. Obviously, it did not require much salesmanship to convince the management of this company that it was poor policy to invest $50,000 in a power plant even though it could produce a kilowatt-hour for less than the company was paying the central station. Instead, the company built an addition to its plant with the $50,000 on real estate that would have been required for the power plant.

Another point with which the power salesman should be familiar and which he should call to the attention of his "prospect" is the relative cost of power to the total expense of the customer's operations. For instance, in the case of a small planing mill each $100 operating cost includes only $3.61 for power; in alfalfa milling power costs 80 cents per ton, less than 4 per cent of the total cost at present market prices; in feed grinding the power cost is ½ cent per sack; in flour milling the power varies from 5 cents to 15 cents per barrel, depending upon the efficiency of the mill; in brick making the power costs from 15 cents to 85 cents per thousand, depending upon the kind of brick made and the method of operation; in coal mining the total power cost is 5 cents per ton of coal mined. The writer knows of one automobile plant where the power cost per car is $2.50, and when it is considered that the car sells for $1,000 it is apparent that an increase of 10 per cent in the power rate would not bankrupt the company.

The purpose of all this is not to criticise the power salesman. With the general lack of proper and definite policies regarding power sales, the salesman has done and is doing as well as can be expected. The fault lies with the men at the head of the industry, who should see to it that these necessary policies are formulated. Give the power salesman a rate schedule sufficiently broad to cover any and every prospective customer's conditions; give him a contract form, comprehensive but not complicated, and then demand of him such a high standard of salesmanship that he can get the name on the dotted line without "shaving" rates or changing contract features.

*From a paper read before the Glenwood Springs meeting of the Colorado Electric Light, Power and Railway Association, 1919.

Avoiding Complaints on Bills in Columbus, Ohio

A feature of the complaint department of the Columbus (Ohio) Railway, Power & Light Company, which handles the complaints on bills, is the fact that everything possible is done to avoid an error before the bills are sent out.

This is made possible by records in the "customers' load factor" book, which simply requires the entering each month of the kilowatt-hour consumption of each customer. The clerk entering this notices at once how the figures compare with the general run of that customer's consumption, and if there is any marked change in the amount he has it investigated before rendering a bill. Between 300 and 500 such cases are investigated monthly, and they usually reveal twenty-five or thirty wrong meter readings, and of course this means twenty-five or thirty fewer complaints, and that many more happy consumers.

DIGEST OF ELECTRICAL LITERATURE

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

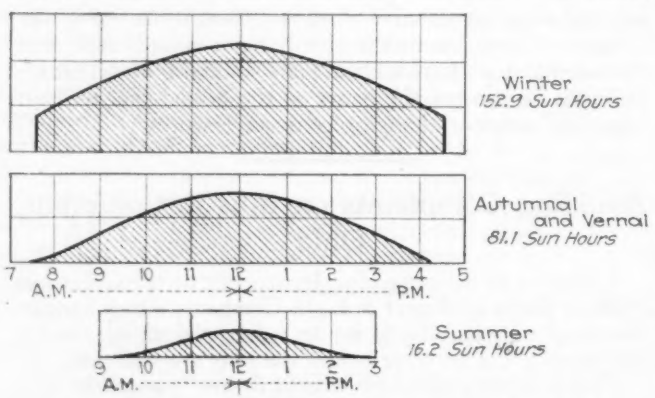
Large Power Transformers.—A. G. ELLIS AND J. L. THOMPSON.—In this number of the series the authors consider particularly the insulation of transformer windings from the point of view of electrical, mechanical, and thermal safety. These points are considered in relation to the rules of the British Engineering Standards Association.—London *Electrician,* Sept. 19, 1919.

Commutation Zone in Wave Windings.—A. THOMALEN.—Expressions are deduced for calculating the width of the commutation zone for wave windings with end connections of different lengths, and the effect of using various numbers of brushes is examined. The investigation is carried out by means of an equivalent two-pole diagram, in which the slots lying under each pole pair are so arranged in separate rows under one another that the conductors lie in diagonal rows in the order in which they are connected in the winding. If the brushes are omitted, the short-circuit period is reduced.—*Technical Review,* Sept. 2, 1919. (Abstracted from *Electrot. Zeits.,* July 3, 1919.)

Reaction of the Armature of Alternators.—E. BRYLINSKI.—In a paper published in the *Comptes Rendus* of the French Academy of Sciences the author examines the influence of magnetic hysteresis in the theory of alternators.—*Revue Generale de l'Electricite,* Aug. 23. 1919.

Lamps and Lighting

Practical Daylight Measurements in Modern Factory Buildings.—EMILE G. PERROT AND FRANK C. VOGAN.—This paper is an attempt to work out data that will enable



SUN HOURS FOR WINDOWS WITH SOUTH EXPOSURE

one to state in advance of the erection of a building just what the intensity of daylight illumination is going to be for certain definite building and window construction. With a view to obtaining such data from existing buildings, the authors secured photometric readings in several buildings, and these form the subject matter of the paper. One interesting development is that represented in the illustration, which shows the relative quantity of sunlight admitted by a window facing south at the winter solstice, the summer solstice and the equinoxes. It will be noticed that for the winter solstice the window in question has the largest number of sun hours, there being 153 in the winter, 81 at the equinoxes and only 16 in the summer, when the days are brightest. In must not, however, be forgotten that the meteorological conditions are less favorable in winter than in summer. The range of brightness of daylight as between summer and winter may be as great as ten to one, so that it is important to get the greatest number of sun hours in the winter time. Distribution curves are shown for illumination in the interior of buildings with various window arrangements.—*Transactions I. E. S.,* Aug. 30, 1919.

St. Louis Street-Lighting Problems.—RALF T. TOENSFELDT.—Stating that a considerable part of St. Louis is still lighted by gas and naphtha, the author discusses a general revision of the lighting scheme in that city which would involve substituting gas-filled tungsten lamps for magnetite lamps used in the business district and also the electrification of the present gas and naphtha district. The problem of showing a decreased operating expense to offset the first cost of such a change is discussed by the writer.—*Journal of Engineers' Club of St. Louis,* May and June, 1919.

Tests on the Resistance of Gas-Filled Tungsten Lamps.—H. PECHEUX.—Characteristic curves and data connecting candlepower, pressure and current are given for filaments burning in an atmosphere of argon. The constants in the relation $L=AE^m$, where L denotes the candlepower, E the potential difference in volts and A and m are constants, are deduced. The spherical reduction factor is approximately 1.08. Specific consumption was 0.80 — 0.85 watt per candlepower on direct current and 0.85 — 0.90 on alternating current. The candlepower increases during the first 170 hours and diminishes afterward. Similarly, both the resistance of filament when cold and the resistance when incandescent first diminish during about 250 hours and then increase. The cause of this initial diminution is discussed. The effect is ascribed to a progressive change in the molecular state of the filament, accentuated by overrunning and due to vibrations on alternating current. Ultimately slow crystallization of the filament causes a rise in resistance.—*Science Abstracts, Section B,* July 31, 1919. (Abstracted from *Rev. Gen. d'Elec.,* May 10, 1919.)

Generation, Transmission and Distribution

Ferro-Concrete Poles for Transmission Lines.—M. FOERSTER.—This describes a method of making ferro-concrete poles which were used on the line between Striesen and Dresden, 40 km. long, carrying energy at 40,000 volts. Hollow molds of wood are filled with the pasty cement mass and put in centrifugal separators. In a few minutes the solid pole is produced in lengths up to 12 m. The

shape and thickness of the walls can be arranged as desired. The normal length of the poles, as they leave the works, is 12 m. Most of those in actual use, however, exceed this length, the extra portion being joined by two cast-iron plate-shaped rings which are screwed to the iron in the two portions and then bolted together. The poles will sustain a pull of 800 lb. at the top end, with a factor of safety of four. Some photographs show the outward appearance of the poles and the methods by which the transmission lines are suspended from brackets.—*Science Abstracts, Section B,* July 31, 1919. (Abstracted from *Elektrot. Zeits.,* April 24, 1919.)

Electric Undertakings in Japan.—In this report the electrical systems of Japan are summarized in a series of tables, one of which is reproduced:

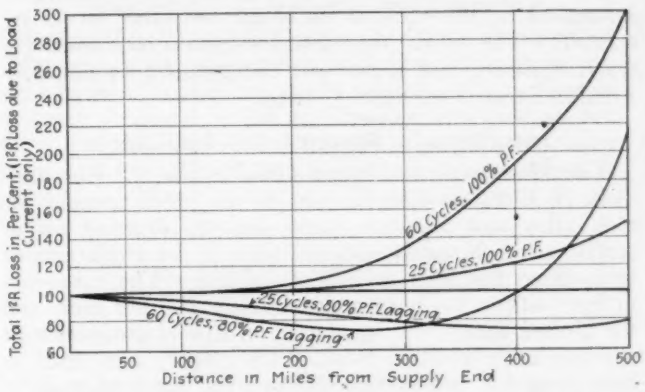
Undertakings	Water	Steam	Gas	Total
Electric supply	338,682	43,675	5,976	388,333
Electric traction	180	1,000		1,180
Electric traction and supply	71,624	68,809	655	141,088
Isolated plants	56,357	123,782	15,567	195,706
Official plants	400	20,630	5,655	26,695
Total	467,243	257,896		753,002

—*Department of Communications,* Tokyo, Japan, June, 1919.

A New Prime Mover of High Efficiency.—F. E. D. ACLAND.—Describes the principle and working of an engine combining the superior thermal cycle at the high temperatures and pressures of the combustion engine with the low thermal cycle of steam to deal with its rejected heat, adding the advantages of the steam engine. This engine, the invention of W. J. Still, uses in its main cylinder any form of liquid or gaseous fuel and uses the recoverable heat, passing through the cylinder surfaces and exhaust gases, for evaporating steam, which is expanded in the combustion cylinder on one side of the main piston, opposite to the combustion side. The jacket and cooling water form part of the circulating system of a steam generator. The cylinder consists of an inner lining about one-third to one-fourth the usual thickness, ribbed externally and reinforced externally by an outer hoop.—*Science Abstracts, Section B,* July 31, 1919. (Abstracted from *Soc. Arts,* July, 1919.)

Power Test on a High-Speed Water Turbine.—W. SCHMID.—Data are given from power tests on one of two similar Escher-Wyss turbines, each of 715 hp., installed in the Thun electricity works in 1917. Each turbine is a high-speed Francis turbine with vertical shaft, running at 150 r. p. m. and using 10,300 liters to 11,000 liters per second under a net head of 5 m. to 6 m. The runner wheel is arranged with a large space between the Fink regulator blades and the runner-wheel blades. Air tubes terminating in this space are open during operation and permit entrance of air. This improves efficiency, particularly at fractional loads. The five tests conducted included long-period runs to determine efficiency, tests to determine maximum power, and tests of the governor gear. The full-load efficiency of the turbine is 83.24 per cent (with generator efficiency 90.2 per cent) and 79.45 per cent at 680 hp. The maximum output with normal head was 743.3 hp. at 79 per cent efficiency, corresponding to a specific speed of 427. On sudden reduction of load from 705 hp. to zero, the frequency increased from 50 to 56 cycles per second (i. e., a rise of 8 per cent above the steady value of 52 cycles, which was reached within ten seconds.) Special advantages of the new turbine are the more powerful units which can be accommodated in a given space, thus reducing capital cost per kilowatt, and the high efficiency realized at high speed, thanks to which water power can be utilized efficiently even at fractional load.—*Science Abstracts, Section B,* July 31, 1919. (Abstracted from *Schweiz. Bauzeit.,* Nov. 10, 1919.)

Electrical Characteristics of Transmission Circuits—III.—WILLIAM NESBIT.—The writer offers a series of tables for quickly determining with the least possible calculation the approximate size of conductor, corresponding to a given I^2R transmission loss from any voltage at



RELATION OF I^2R LOSS TO TRANSMISSION DISTANCE

the load between 220 and 220,000. Although the power factor of the load and the charging current of the circuit, as well as any change in the resistance of the conductors, will alter the I^2R loss, it is impracticable to make up tables which will take into account the effect of all these. The effect of charging current, corona or leakage loss is not taken into account in these tables. The effect of charging current on the ohmic loss in transmission lines due to the change in frequency in power factor is shown in the tables reproduced from the original.—*Electric Journal,* September, 1919.

Traction

Electric Traction in Silesia.—E. C. ZEHME.—A general description is given of the electric railway system in the Silesian mountains. As the total available water power (9400 kw. peak load) was not sufficient to run the railways, a generating station burning a local low-grade coal was erected at Mittelsteine to supply single-phase alternating current at 15,000 volts, 16⅔ cycles. The station contains four turbo-dynamos, each of 500 kva. rating at 1000 r.p.m. and with 3500 volts terminal pressure. Provision is made for adding six units more. Besides these machines three 2500-kva. dynamos are installed to supply power to neighboring mines. The total length of the railways served is 500 km. of track, and the grades and curvatures are particularly severe.—*Technical Review,* Sept. 16, 1919. (Abstracted from *Elektrot. Zeits.,* July 17, 1919.)

Electrification of Railroads.—A report rendered to the French Ministry of Public Works by Prof. A. Mauduit, one of the members of the technical commission sent by the French government to the United States to study the problems involved in the electrification of steam railroads. As a result of his investigations Professor Mauduit favors the use of 3000-volt direct-current electricity, the system adopted by the Chicago, Milwaukee & St. Paul Railway. —*Revue Generale de l'Electricite,* Aug. 30, 1919.

Alternating-Current Track Circuit.—Douglas C. Gall.—The author deals with the problem of alternating-current track circuits, which he says is the problem most frequently encountered by the railway signal engineer. Electrically their properties are: (1) The insulation resistance of the ballast; (2) the impedance of the rails; (3) the impedance of the circuit through the wheels in contact with the rails. This latter property is one about which little appears to have been written. It is said that unless the wheel impedance is below a certain value the track circuit will not operate with a train in it, and that, further, the value of this impedance is largely influenced by the ratio of its ohmic resistance to its reactance. The writer then assumes certain conditions for track signaling and works out the problem in detail.—London *Electrician,* Sept. 5, 1919.

Installations, Systems and Appliances

The Manufacture of Ferro-Alloys in Electric Furnaces.—C. B. Girson.—On account of the great demand for tool, alloy and munition steels and the shutting off of certain alloys formerly obtained abroad, the production of ferro-alloys has been greatly stimulated. The expansion in ferro-silicon has been approximately 100 per cent, and the United States now leads with an annual production of approximately 100,000 tons. This country also leads in ferro-tungsten, and considerable progress has been made in ferro-chrome and ferro-manganese. The author gives the principal uses of the ferro-alloys in making steels of different properties and sums up their production in the United States in gross tons for the year 1918 as follows: Ferro-manganese, 345,000; ferro-silicon, 100,000; ferro-chrome, 30,000; ferro-titanium, 15,000; ferro-tungsten, 8,000; ferro-vanadium, 5,000; ferro-molybdenum, 300; ferro-uranium, 100. After discussing the types of electric furnaces for the manufacturing of these alloys, the author gives a table showing typical results for the manufacture of ferro-alloys in regard to type of furnace and energy consumption. He states that in general large furnaces can produce most of the ferro-alloys at a cheaper price per pound than small furnaces, but still there is no advantage in building the furnace of such a size that the necessary kilowatts per ton of charge cannot be supplied to it.—*Electric Journal,* September, 1919.

POWER REQUIRED FOR SMELTING FERRO-ALLOYS

Alloy	Grade Product, Per Cent	Size of Furnace		Type Furnace	Electrode Voltage	Per Cent Recovery	Kw. hr per lb. Alloy Tapped
		Tons Charged	Kilowatts				
Ferro-chrome	60-65 Cr. 4-6 C	13-15	750	3-ph.	120	70-80	3-4.5
Ferro-manganese	75-80 Mn.	15	1200	3-ph.	72	70-85	2.2-3.3
Ferro-molybdenum	60-65 Mo. 15-2 C		150	1-ph.	65	78-80	7-7.5*
Ferro-tungsten	70-75 W.	0.75	150	1-ph.	95	80-90	Smltg. 1.1 Refg. 1.7 Total 3.8
Ferro-vanadium	30-35 V 3-4 Si.	1	150	3-ph.	65	75 av.	3.4
Ferro-uranium	35-50 V. 3-4 C.	800 lb.	75	1-ph.	35-65	75	3-5
Ferro-silicon	50-70	3-4	1000	1-ph.	60-90		2.3-3

*Per pound of Mo. in alloy.

Electric Speed Indicators.—Victor H. Tood.—A discussion of electric tachometer schemes, dealing principally with the method of connecting and gearing the direct-current magnetos for the indication of speed—*Power,* Sept. 9, 1919.

Electricity in German Mining Industry.—M. Philippi.—Numerous new electrical installations for mining purposes have been made during the war. The three-phase double-commutator motor has become less favored for haulage plants and will probably not be greatly used in the future for such installations. Ilgner haulage motors have shown great advantages for moderate outputs, with provision for cutting the converter (without flywheel) out of circuit after each haul, in order to save light-running losses. For larger outputs of several thousand kilowatts the induction motor is coming into increasing use. The use of alternating-current commutator motors regulated by brush shifting is becoming unusual for mine locomotives, the direct-current system having been found to be preferable, both from the point of view of economy and from considerations of safety of the workers. Electric generating stations have been built in many cases near coal mines for the cheap generation and distribution of electrical energy. Notwithstanding the large scale of these stations, the cost of generating electricity has not decreased, owing to the increased cost of steam production, which may be taken at present at 4 marks per ton of steam, or double the cost before the war.—*Technical Supplement Review of Foreign Press,* May 13, 1919. (Abstracted from *Elektrotechnische Zeitschrift,* Feb. 27, 1919.)

Electrophysics and Magnetism

The Magnetic Properties of Some Rare Earth Oxides at Low Temperatures.—E. H. Williams.—The magnetic preperties of several rare earth oxides have been studied at temperatures varying from room temperature to 150 deg. C. and the results compared with values previously obtained at high temperatures. It is found that while good agreement is obtained at room temperature where the two measurements overlap, the value of *theta* in the expression X (T plus *theta*) = const. is smaller for low temperatures than for high temperatures, thus indicating that Curie's law is followed more closely at low temperature for the oxides investigated.—*Physical Review,* October, 1919.

Harmonic Analysis.—L. Puget.—Instead of choosing ordinates at uniform intervals, the author proposes to select singular points on the curve—that is, maxima, minima, pronounced bends, etc.—such that the error in taking straight lines joining these points as representing the curve is not great. He shows how the coefficients can be determined from these points. The method has the advantage that in most cases a very small number of ordinates give sufficiently accurate results. A method of estimating the amount of error incurred is given and an example is worked out in which only three ordinates selected at maxima and minima are used, giving very much more accurate values for the coefficients than three equally spaced ordinates.—*Science Abstracts, Section B,* July 31, 1919. (Abstracted from *Rev. Gen. d'Elec.,* March 22, 1919.)

Electrochemistry and Batteries

Action of Impurities in Lead Accumulators.—O. Scarpa.—In a former article the author published the results of his researches upon the influence of plate impurities of lead accumulators. In the present article the author gives the results of experiments upon the impurities contained in the liquid. Some metals, such as Sb and W,

if separately or at the same time contained in the electrolyte, have very little influence. Copper has also very little action, if alone. But if Sb and Cu are contained at the same time in the electrolyte, the loss of capacity is rapid; and this is still more rapid if the impurities are formed by W and Cu existing at the same time in the liquid. In one case the energy furnished by an accumulator which normally was 90 per cent of that absorbed for charging diminished to 15 per cent when W and Cu were contained in the liquid. The negative plates are especially damaged by such impurities, as they discharge themselves and become covered with lead sulphate.—*Science Abstracts, Section B,* July 31, 1919. (Abstracted from *Elettrotecnica,* June 5, 1919.)

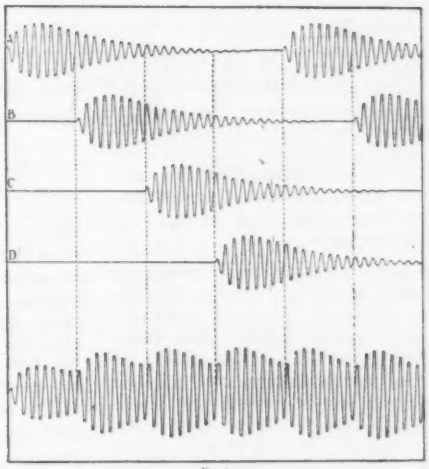
Units, Measurements and Instruments

Use of Amplifiers for the Measurement of Slight Differences of Potential.—A. Blondel.—Hitherto no apparatus has been available possessing great sensitivity for measuring difference of static potential. The use of thermionic amplifiers of the audion type for such measurements is discussed in this article. The author reviews the various laboratory methods in which the audions can be utilized, using them under the same conditions as for telephonic amplification. The following methods are reviewed and their principles explained, with diagrams showing the various connections and formula for the calculation of deviations and sensitivities: I. *Thermionic Balance Method.*—Single thermionic balance with audion mounted on differential galvanometer; double thermionic balance with relay audion; double balance with a single "pliotron" type lamp; balance with electrometer as measuring apparatus. II. *Static Bridge Method* (Blondel and Touly).—Single static bridge; double symmetrical bridge. III. *Deviation Bridge Method.*—Single deviation bridge; double dissymetrical deviation bridge; double symmetrical bridge; single deviation bridge with electrometer as measuring apparatus; dissymetrical deviation bridge mounted on two banks of amplifiers; dissymetrical deviation bridge mounted on audion with transformer for using rheograph as measuring instrument; use of bridge method with oscillograph. IV. *Potentiometric Methods.*—J. M. Miller's method for measuring alternating emfs.; alternative method. A diagram and equation are also given of the arrangement for measuring the internal resistance of an audion.—*Technical Review,* Sept. 2, 1919. (Abstracted from *Revue Generale de l'Electricite,* Aug. 9, 1919.)

A Rectangular-Component, Two-Dimensional, Alternating-Current Potentiometer.—A. E. Kennelly and Edy Velander.—Of this alternating-current potentiometer it is said: (1) The principle is not new, but the form of the instrument appears to be new. (2) By the use of this instrument alternating potential differences can be measured to rectangular co-ordinates up to at least 2000 cycles, with only a small expenditure of power. (3) The use of the instrument shows the marked influence of distributed capacitance in alternating-current apparatus and the importance of reducing this disturbing effect when measurements are made. (4) The importance of a proper ground connection in the working circuit is emphasized. (5) The alternattng-current rectangular potentiometer escapes the necessity of measuring the strength of alternating current in either the potentiometer circuit or the working circuit, provided that the relative method is used and that the impressed frequency is maintained constant. (6) Owing to the effects of distributed capacitance the voltage distribution in a simple series resistance box carrying alternating currents fails to follow a vector straight-line law. The deviation tends to increase with the impressed frequency. (7) The importance of reducing the mutual capacitance between the concentric primary and secondary windings of the toroidal induction coil, at high frequencies, is emphasized as the result of experimental tests.—*Journal Franklin Institute,* July, 1919.

Telegraphy, Telephony and Signals

Marconi Time-Sparked Continuous-Wave Transmitter.—The generation of continuous oscillations such as are now extensively used for radio-telegraphic signaling is commonly produced by the high-frequency alternator, arc systems such as the Poulsen arc, the three-electrode valve scheme and, in addition, spark methods, one of which is known as the Marconi system. The production of a continuous wave from a damped spark discharge has been brought about by the introduction of multiphase spark apparatus in which several quenched or rotary spark gaps were employed, each working on a separate phase of the supply circuit but feeding on a common aerial circuit. In this manner the frequency of the discharges at each individual spark gap is reduced in proportion to the number of phases, although the resultant effective high-discharge frequency is maintained. By reducing the number of discharges to an exact sub-multiple of the oscillation frequency, it is possible to secure a fresh energy impulse to the aerial circuit once in every two, three or more oscillations instead of once in every one. The wave radiated will not then be quite undamped but will still be continuous, although the amplitude will be waxing and waning slightly between successive spark discharges.—*Wireless World,* September, 1919.



CONTINUOUS WAVE BY TIMED-SPARK METHOD

Miscellaneous

British Engineering Standards Association.—The article says that the dominions of the British Empire have created agencies for co-operating with the British Engineering Standards Association. It seems assured that British and American societies could co-operate in matters relating to engineering standards without difficulty.—London *Engineering,* Aug. 1, 1919.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

The trouble in the New York printing trades is over and the men have returned to work. Details of this happy outcome will be found in the publisher's announcement immediately preceding page 857. For the present, however, and until the issues have "caught up" with the calendar, the ELECTRICAL WORLD *will continue to be printed at Buffalo, N. Y., in accordance with the plans adopted while the strike was on.*

Summarized News

Principal Happenings Up to Closing of Forms for This Issue— Printed Dec. 1

Threatened shortage of coal resulting from the bituminous coal strike has interfered in various parts of the country with the normal operations of the central-station industry. Where supplies are short a number of communities are conserving them by the adoption of restrictions on the consumption of energy for non-essential purposes.

Lightless nights are again in evidence in many towns and cities of the Middle West as a result of the coal shortage. The Commonwealth Edison Company, Chicago, has appealed to the public in newspaper advertisements to curtail the use of light and power. Every day more factories which depend upon their own source of power are forced to shut down for lack of fuel. Conditions are very acute in a number of communities where coal is short.

Orders are pouring in to jobbers faster than they can handle them in almost every section of the country. Stocks on hand are continually getting smaller, and incoming shipments in many cases are quickly absorbed by back orders. In some places building is being held up by the shortage of electrical supplies, especially conduit of one kind or another. In general, however, there appear to be enough electrical supplies in local stocks to take care of new building that is ready for the electrician. The greatest worry is on account of future stock. A very active demand is expected with the spring months, and jobbers are particularly anxious to be able to meet it with sufficient stocks. Owing to the steel strike conduit supplies are probably in worst shape. The best condition that now obtains is spotty.

Flexible armored conductor stocks are still low, and in some sections of the country, especially the South, small sizes of weatherproof wire have virtually disappeared. Socket device demands are running stronger. Some deliveries in the Northwest have helped the trade there a great deal. Higher prices are being quoted on the Pacific Coast on rubber-covered wire and lamp cord. In the Middle West lamp cord is bringing a premium while enameled wire is so scarce that manufacturers of small coils are having to refuse orders. A drop of 10 per cent in solder is reported from this region. Line material in the South is up 10 per cent and poles are up 15 per cent. A good supply of "Nail-it" knobs is reported this week in New England, but stocks of dry cells and fixtures are low.

Motor stocks under industrial and appliance demands are now about gone and shipments are rapidly lengthening. A number of second-hand direct-current motors are coming on the market from New England industrial plants, but no disturbing influence is felt. With the exception of the instances above mentioned, prices have been very stable, and it seems doubtful if any very heavy changes will occur before the first of the year. When inventories have been made and costs generally figured out, it would not be surprising if a number of advances were made.

James Burke, H. M. Hobart and H. E. Chubb, delegates of the American Institute of Electrical Engineers to the plenary meeting of the International Electrotechnical Commission held in London, beginning on Oct. 20, returned to New York on Nov. 25. Dr. C. O. Mailloux, who was also one of the delegates and who was elected president of the commission, is expected to sail from England on Dec. 2 for this country.

Among the larger projects contemplated are extensions and improvements to the plants and system of the Kentucky & West Virginia Power Company of Logan, W. Va. The proposed work will include the installation of ten 500-hp. Edge Moor boilers, ten Detroit stokers, C. W. Hunt conveying equipment, three 4000-kw. General Electric turbines, three 5000-kva. General Electric 60-cycle, 2300-volt generators, switchboard equipment and transformers. About fifty substations will be erected over the coal field of Logan and Mingo Counties and also in a part of Boone County. About 100 miles of 44,000-volt transmission lines will be erected and about 1000 General Electric meters used. The company will require electrical supplies costing about $75,000 for its own use. The main plant of the company is in Logan. John R. Adams is engineer in charge.

Chairman Eugene Schneider of the French Mission to the United States informed the International Trade Conference at Boston on Nov. 20 that production in France is now greater than before the war, owing partly to electric power.

The electrical trade as a channel for distribution was discussed at a two-day meeting of the American Washing Machine Manufacturers' Association in Chicago last week. Special consideration was given to the ethics of the premium plan, to merchandising and to the shortages in the supply of motors, copper sheets and wringers.

The United States battleship California, a 32,000-ton dreadnought, was launched at San Francisco on Nov. 20. Like the New Mexico, the California is electrically driven. According to plans announced in San Francisco two 19-knot passenger vessels equipped with turbo-electric drive will be in operation between San Francisco and Los Angeles by next April.

After long investigation and experimentation the New York Telephone Company has developed a machine-switching central office system which has proved so satisfactory in trial installations as to justify its use in several places in the company's territory. Installations are being made in Dunkirk, Ithaca and Geneva, and this work will be completed about Jan. 1. It is expected that installations can be completed in several new central offices in New York City next year.

The following meetings of committees of the National Electric Light Association are announced to take place in December: Inductive interference, Denver, Col., Dec. 1-3; overhead systems, Denver, Col., Dec. 1-3; meters, Fort Wayne, Ind., Dec. 2; membership, New York, Dec. 3; credits and collections, New York, Dec. 3, executive committee, N. E. L. A., New York, Dec. 4; prime movers, Pittsburgh, Dec. 8, and bonus system, New York, Dec. 10. A meeting of the underground systems committee will also be held during the month.

One of the most successful meetings in the history of the Electrical Manufacturers' Club was held at Hot Springs, Va., on Nov. 19 to 22. Addresses were made at the meetings by W. G. Merritt and Dr. B. C. Tremaine. LeRoy Clark, president of the Safety Insulated Wire & Cable Company, New York, was elected president for the ensuing year. The other officers elected were: Vice-president, Edward B. Hatch, Johns Pratt Company, Hartford, Conn; secretary, F. L. Bishop, Hartford Faience Company, Hartford, Conn.; treasurer, Sears B. Condit, Condit Electrical Manufacturing Company, Boston; commissary, F. W. Sanford, General Electric Company, Harrison, N. J.

THE ENGINEER'S DUTY IN PRESENT-DAY PROBLEMS

E. W. Rice, Jr., Says that Great Suffering and Even Economic Disaster Impend if Production Is Not Greatly Increased

E. W. Rice, Jr., president of the General Electric Company, made an address on "Present-Day Problems" before the Eastern New York Section of the American Society of Mechanical Engineers at Schenectady on Oct. 28. It was the first meeting of the section.

Mr. Rice spoke of the close similarity between the activities of the electrical engineer and the mechanical engineer, saying that one cannot imagine a single piece of electrical apparatus, large or small, that could be designed and manufactured or used without the assistance of the material methods and practical experience of the mechanical engineer.

"Engineers have been so busy increasing the productivity of man," said Mr. Rice, "that they have not had time to think much of other matters. They perhaps have not noticed that many people who have profited thereby have been equally busy in an effort to decrease the productiveness of man. It is true that such people have always existed, but the creations of our engineers have been so numerous and so effective that the world's production has increased amazingly, in spite of the opposing influences. This was true in our country, at least prior to the war. Our engineers are workers and not talkers. They have therefore been inclined to ignore the talkers who were not workers.

"This attitude was fairly safe as long as the talkers had no influence on the result. However, the situation has greatly changed during the past few years. The great world war turned the efforts of our producers largely from the production of material goods for a world at peace to the production of articles demanded by war. Millions of producers were also taken out of production and diverted to form the armies and navies and to take care of their supply and maintenance. A tremendous shortage of things needed to support our people in the condition and the standard of living which had previously existed was the natural result. Besides the loss of the production of useful goods, there was of course added the tremendous destruction and wastes of war, in material and men, on a scale unequaled in the world's history.

"With your training and record you would of course bend every energy to replace the destroyed goods and increase the output of the world's farms, factories and mines and improve the methods of transportation, not only so as to meet the current demands but to make up for the losses of five years. Our country, and the whole world, needs to produce greater quantities of every useful thing than ever before in its history. Great suffering and even economic disaster face great masses of people if such production is not greatly increased and maintained for a long time, and that quickly.

"Most of our people, certainly all those who think clearly and without passion and prejudice and who feel their responsibility to humanity, agree with us and are willing to put forth every reasonable effort in this direction. Unfortunately, there are those that act as if they did not see the world's need, or, seeing it, did not care. They demand shorter hours, although this means loss of production, and strike, actually stopping production altogether for a time, in order to enforce their demands for lessened production.

"I am anxious to see engineers devote time to the study of economic facts and principles. I feel sure that if you approach this investigation in the same spirit and use the same methods that you employ in solving your mechanical problems you will arrive at a satisfactory solution.

"The high cost of living is one of the problems which many would claim to be our basic present-day problems. The ultimate solution from the standpoint of an engineer would seem to be increased production, so that the world may have an abundance of things which are needed or desired. Until this increased production has been obtained and a bountiful supply of goods realized, it would seem to be our necessary but painful duty to restrict our desires and demands as much as possible and make the same sacrifices which were cheerfully made during the war."

MOHAWK EDISON COMPANY CONSOLIDATION APPROVED

New Schenectady Company Acquires Adirondack Company and Other Properties—Better Service and Distribution Assured by Unification

The New York Public Service Commission, Second District, has granted the required authority whereby the Adirondack Electric Power Corporation of Glens Falls may transfer its franchises and property to the Mohawk Edison Company, Inc., of Schenectady.

The Mohawk Edison Company was formed recently to take over the Schenectady Illuminating Company, the Schenectady Power Company and the Mohawk Gas Company of Schenectady, the Edison Electric Light & Power Company of Amsterdam, the East Canada Electric Power Company, operating hydroelectric power plants near Schaghticoke and on the East Canada Creek and serving, principally with electricity, parts of Schenectady, Saratoga, Rensselaer, Montgomery and Fulton Counties.

The Adirondack Electric Power Corporation operates hydroelectric plants at Spiers Falls and Mechanicville and supplies electricity in several counties in which the Schenectady companies operate and a steam plant at Utica supplying electricity for trolley-car operation in that city and lighting and power service in Oneida. The Adirondack company has recently hooked up its Spiers Falls power output with its Utica and Oneida service by means of a transmission line from Amsterdam west.

The object of the transfer is that better service and distribution of the output of the generating plants shall be accomplished by a unification of the various hydroelectric plants which now serve the communities named.

The order of the commission approves an issue of $20,300,000 in securities by the Mohawk Edison Company and the assumption by it of outstanding bonds of the Adirondack company totaling $5,000,000. Authority is also given to the Mohawk Edison Company to issue a mortgage on all its property, to be approved by the commission, to secure first mortgage 5 per cent bonds to the amount of $6,500,000 ten-year 5 per cent debenture bonds or a like amount of 7 per cent cumulative preferred stock, $1,800,000 in cumulative preferred stock and $9,500,000 in common stock.

The securities to be issued are for refunding outstanding bonds amounting to $2,878,000, to discharge bills and accounts payable amounting to $3,178,750, to reimburse

the company's treasury in amounts totaling $1,008,976, for working capital $150,000, and for outstanding common stock of the Adirondack company for stock of the Mohawk Edison Company.

LINE EXTENSION POLICIES DISCUSSED IN INDIANA

Central Stations Meet Commission to Determine How Rural Customer Shall Be Served and How City Lines Shall Be Extended

A conference of the Public Utilities Commission of Indiana and the central stations of the state on Oct. 29 devoted one-half day's session to consideration of the rural electric service problems and another session to consideration of standards of service to apply within corporate limits of cities. As chairman of the central-station committee on rural problems, Alex R. Holliday, Indianapolis, submitted a report covering the general policy which the central stations of Indiana feel should govern the building of rural electric service lines. This report follows:

1. A rural customer is one whose premises are without the corporate limits of the city or town and one requiring a greater investment per customer.
2. A rural customer is entitled to electric service provided he will pay the central station for this service.
3. The central station's charge to the rural customer will not be discriminatory; obviously the charge must therefore be greater than the city customer's charge. It must be profitable to the central station and bear its fair share of expenses, taxes, depreciation, cost of money to central station and return to the central station.
4. There shall be two charges for service, primary and secondary. The primary charge shall include the constant cost of readiness to serve; the secondary charge shall be based on consumed energy corrected back to the corporation limits for line and transformer losses and billed at tariffs for such consumption prevailing in that town or city served by the central station.
5. New customers taking service from previously built lines shall share in the charges incurred by the previous investment.
6. Guarantee satisfactory to the central station shall be made by the rural customer to remain a customer over a period of years and to fulfill his contract in other respects.
7. Safety in construction and maintenance is essential. Divided ownership and responsibility are against public policy. Therefore the construction of lines by inexperienced persons or companies shall be discouraged. It is recognized that when demanded central stations, in order to comply with the law, must furnish energy at filed tariff rates, but it is also recognized to be the duty of the commission and the central station to warn such prospective users of the danger to life and property in handling energy at lighting voltage and that this portion of the problem has nothing in common with the rural telephone lines.
8. In order to obtain safety and uniformity, central stations must acquire existing lines and may own future lines.
9. The practice of central stations of financing rural extensions through the customers furnishing money or buying securities at par is approved as the present cost of money to the central station is abnormally high.

Clause No. 2 in this report evoked a great deal of discussion. The commission frankly stated that it questioned the truth of clause No. 2 under the Indiana laws. While it felt that the farmer is morally entitled to electric service, it also felt that the legal side of the question was quite different. The discussion showed many of the municipal plant representatives that they are furnishing a considerable quantity of electric service to farmers at less than cost, and that they are taking a dangerous liability on some of their lines. A committee was appointed to draw up a standard form for the use of electric service companies in compiling specific data on the losses in rural electric service lines, to be used in establishing rates for rural service.

The standards of service for operation within corporate limits of cities differ only from the old standards of Indiana in that changes have been made in Rule 31. In this rule the commission suggested that a free extension should be made where the estimated income for a period of three to five years equaled the cost of the extension. The central stations contended that this should be limited to a two-year period. The commission further suggested that utilities should refund an amount equal to the cost of a free line extension for each additional customer whose service is taken off a paid extension within eight years from the making of the extension. The central stations contended that this should be a period of five years instead of eight years. The commission has reserved its decision.

IMPORTANCE OF SAFEGUARDING INTERBUILDING CONNECTIONS

Desirability of Rephrasing Rule 17d in National Electrical Code Pointed Out Before National Association of Electrical Inspectors

At the Springfield (Mass.) convention of the National Association of Electrical Inspectors Hubert S. Wynkoop, M. E., New York City, presented a paper on "Interbuilding Connections" which emphasized the importance of safeguarding current practice in this direction through the rephrasing of Rule 17d in the National Electrical Code. The author pointed out that the ideal situation from the insurance standpoint would exist if an isolated plant never had to serve other than its own building and if the central-station company always could provide a separate service for each building. But in practice it appears that the continually improving economy of the incandescent lamp releases generator capacity which can be used next door; that the lighting company cannot open a new pavement which has just been laid; that some influential industry on a rear street where no main exists must be supplied, and that some person who has no franchise sets up a block lighting plant and schemes in every devious manner to evade the rule.

The solution, in the author's opinion, must hinge upon inter-accessibility. The one-roof or structural idea cannot be utilized, for a business may expand from a three-story building into a four-story building next door, and the occupant may cut doors and run the two as one establishment. The ruling cannot be based upon occupancy, as the occupant may control a number of adjoining warehouses which he prefers to keep separated from each other by unpierced fire walls to reduce the insurance rate. Neither can practice be governed by ownership, as one individual may own an entire row of separate apartments.

Discussing the paper, Washington Devereux, Philadelphia, stated that in his city the fire marshal had to cut down the isolated-plant lines and seal up the openings on account of fires. The extension of isolated-plant lines for commercial purposes other than on the plant's own property has been eliminated.

L. L. Elden, Boston, stated that the Boston Edison company successfully feeds buildings in a row. He considers its method of construction as safe as a vertical riser and that the provision of separate switch, fuses and meter at each installation, no matter if the occupant uses but a few lamps, segregates the individual services satisfactorily.

ILLINOIS ASSOCIATION CONVENTION IN CHICAGO

Members Told How to Present Cases to Commission—Longer Periods Between Meter Tests —J. B. Denman Again President

Discussion of a paper read by R. A. Keller of the Central Illinois Light Company before the annual convention of the Illinois State Electric Association at Chicago, Oct. 23 and 24, emphasized the need of eliminating certain installation tests on meters and of lengthening the time between periodic tests. Records of a number of central stations in the state show that over 90 per cent, and in one case 98 per cent, of meters tested at time of installation were less than 4 per cent fast or slow. The cost of installation tests is higher than that of routine tests, and as the meters are tested in the laboratory before installation it was generally conceded in the discussion, led by R. B. MacDonald of the People's Power Company, that the present sixty-day limit for test after installation should be increased. A committee was appointed to present the subject to the state utilities commission.

Making a profit out of service to rural customers was shown to be possible in the paper read by D. E. Snyder, Bloomington. By the use of a schedule having a service charge which includes core loss, maintenance and depreciation, etc., and a low rate for energy, much profitable business of this description has been secured by several companies of Illinois. It was thought advisable to have customers maintain the 2300-volt and 4600-volt lines built at their expense. Some valuable data were contributed to the discussion by E. H. Negley, Canton. A committee was appointed to study the method of fixing rates and to present these rates to the state utilities commission.

Bert H. Peck, formerly electrical engineer for the Illinois Public Utilities Commission but now of the Southern Illinois Light & Power Company, gave some pointed information on the preparation of cases for presentation to the commission. He stated that the case should be just; the arguments should be convincing and in logical sequence; prescribed forms and facts which the commission has previously deemed worthy should be used; full facts should be given and care should be taken to deny all false statements of the opposition, as the commission can judge only by the evidence submitted. The employment of a good lawyer was advocated by F. A. Warfield of the Illinois Traction System and others.

Protection of transmission lines from lightning and other overvoltage was reviewed by A. Herz, Public Service Company of Northern Illinois. Overbuilding sections of the line with a substantial ground wire in addition to arrester protection was discussed as a practice that is giving profitable results in most cases. In the discussion J. L. Buchanan, General Electric Company, gave some valuable information on lightning arresters.

Selling electrical goods and service was treated in a joint paper by D. R. Hogue, George H. Jones, Harold Wright and E. A. Edkins, all of Chicago.

The value of an originial statistical department in a central station to correlate the financial and operating ends of the company for presentation of costs to higher officials and for keeping accurate composite records was demonstrated in the talk of E. J. Fowler of Chicago and by H. E. Weeks, People's Power Company, in the discussion.

The evidence of application of outdoor high-tension substations and the advantages of unit construction were explained in a paper by H. M. Young, Chicago. The discussion, in which John Leisenring of the Illinois Traction System and Harry Caldwell of the Public Service Company of Northern Illinois entered, brought out the public policy value of sightly and safe construction.

The advantages of educating employees and stockholders to uphold publicly a company's policy and integrity and of spreading good will through increasing the number of stockholders was outlined in the paper of Mr. Gilchrist of Chicago. B. J. Mullaney, Chicago, presented the paper in the author's absence.

W. R. Leeper of the United States Chamber of Commerce made a short plea for co-operation with that body during the present adverse conditions.

B. J. Denman, Moline, was re-elected to the president's chair. Adam Gschwindt, Rockford, was elected vice-president, and the office of secretary-treasurer again went to R. V. Rather of Springfield. Marshall Sampsell was appointed to the executive committee, whose other members are H. E. Chubbuck, Peoria; D. E. Parsons, East St. Louis; R. S. Wallace, Peoria; Frank J. Baker, Chicago; H. O. Channon, Quincy, and W. A. Baehr, Chicago.

PROVIDENCE COMPANY IS TO UTILIZE FUEL OIL

Narragansett Electric Lighting Company Makes Contract for Supply to Its Tidewater Generating Station and Plans Changes in Equipment

The Narragansett Electric Lighting Company, Providence, R. I., has executed a contract with the Standard Oil Company of New York for the supply of fuel oil to its tidewater generating plant in Providence. The Narragansett company's engineers are at work upon the problem of burner selection and installation and a portion of the boilers in this plant will probably be equipped for simultaneous operation with fuel oil and coal. Other sections will probably be operated with oil alone.

COMMITTEE TO STIMULATE THE USE OF MORE OUTLETS

Work of National Electric Light Association Body to Focus Attention on Adequate and Convenient Service Outlets

A number of resolutions designed to stimulate the installation of more outlets were passed at the meeting of the "more service outlets" division of the advertising and publicity service bureau of the National Electric Light Association in Chicago on Oct. 22. They are in substance as follows:

That this committee recommends that electrical manufacturers in illustrating applications of their devices in advertising show appliances connected with baseboard and chair-rail outlets rather than to lighting fixtures.

That steps be taken to induce manufacturers of portable lamps to show lamps connected to outlets in illustrations in advertising.

That it would be desirable for manufacturers of wire, wring devices, etc., who do national advertising to include in their copy an appeal to the public to use more outlets, and that manufacturers who do no national publicity but carry on local newspaper advertising over the dealer's name introduce the same argument.

That central stations be urged to have one man in each company cultivate the acquaintance of architects in their territory and

familiarize them with the advantages of specifying more outlets.

To recommend to central stations the desirability of frequently circularizing the public with mail matter on the desirability of more outlets and that the Society for Electrical Development be asked to consider preparation of literature of this character.

That the committee notify manufacturers of outlets, wire, wring devices, etc., of the desirability of having printed matter, posters, folders, cartoons, etc., contrast the convenient outlet with the inconvenient one.

That the name of the committee be changed to the "adequate outlets committee."

BUFFALO CONVENTION OF EMPIRE STATE ASSOCIATION

President Palmer Believes that the Worst of the Unusual Conditions Has Passed and We May Now Look for the Brighter Future

The fifteenth annual convention of the Empire State Gas and Electric Association was held at Buffalo, N. Y., on Oct. 23 and 24. The convention was called to order in the tower room of the Electric Building on Thursday morning by E. H. Palmer, president of the association. He introduced C. R. Huntley, president of the Buffalo General Electric Company, who welcomed the delegates. Mr. Huntley mentioned that Buffalo had been the pioneer in many matters electrical and outlined the history of the development of the industry there. He introduced Edward McCarthy, president of the Buffalo Electric Show, who extended a cordial invitation to the members to visit the show.

Mr. Palmer in his presidential address said that in his opinion the most important accomplishment of the association during the past year and during its entire existence had been to prove to the public service commissions that it is worthy of their confidence. The association has tried to co-operate with the commissions; it has confidence in them, and its object in the future as in the past should be so to conduct its affairs that the commissions in turn will always have confidence in it.

Mr. Palmer then summarized the unusual conditions that have confronted the industry during the last few years, expressing the belief that the worst is past.

The first paper of the meeting, on "Accounting for Property Withdrawn from Service," presented by the accounting committee, was read by H. M. Brundage of the Consolidated Gas Company, New York.

The accounting committee, he said, had made a critical analysis of the present uniform system of accounts and had submitted to the commission of the Second District numerous recommendations as to revisions based on experience of the last ten years. Several conferences have already been held, but the pressure of other work has made it impossible for the commission to take action making any changes effective by Jan. 1, 1920. Among the most important suggestions are those relating to so-called depreciation, and in this connection the committee has recommended the creation of accounts designated "property retirement expense," "property retirement reserve" and "unamortized fixed capital."

This report was followed by a paper prepared jointly by the chairmen of the electric distribution, electric production, gas distribution and gas production committees and read by R. M. Kellogg, Westchester Lighting Company. The subject of this paper was "Job Order Systems from the Standpoint of the Engineering Departments," and the object of its presentation was to point out the necessity for co-operation between the engineering department and the accounting department, particularly in determining the accounts to which different items of expense should be charged. The paper stated that the function of the accountant is to record events of the company's day-to-day operations, their character, their purpose, their cause and their cost. The engineer is responsible for planning and executing many of the transactions which the accountant records in his books. He has personal knowledge of the facts. Evidently, therefore, there should be some link between the two departments by means of which the story of any transaction can be furnished by the engineer to the accountant. A job order system constitutes such a link and serves related purposes also.

Two questions arise in reference to which there are differences of opinion. These are, first, should the work order be prepared by the engineering department or the accounting department and, second, should the engineering or the accounting department decide whether the work constitutes an addition, a retirement or a repair and to what accounts the expense should be charged? From their intimate acquaintance with the character and details of the work when it is actually done, the engineering departments are in a position to classify the cost accurately under the headings required by the uniform system of accounts provided that they have familiarized themselves with the system, which they can readily do. The accounting departments, however, on account of the character of their work cannot personally supervise operations and must therefore base their decisions on second-hand information. For this reason it would appear logical that the work order and the final allocation of the various items of cost should originate with the engineering departments.

At the opening of the afternoon session the secretary read a letter of regret from Chairman Hill, Public Service Commission, Second District, who was to have addressed the meeting. E. J. Cheney, chief of the division of light, heat and power, Public Service Commission, Second District, then spoke informally on "Complaints and Public Relations." He quoted a few random complaints received by the commission and emphasized the necessity of the companies trying to appreciate the consumer's point of view. Rules, he said, were necessary but were a continual source of irritation and should therefore be based only on the soundest principles and explained so carefully that their reasonableness would be apparent to any one.

In the concluding discussion a number of brief papers on different kinds of rates were read. A new plan was tried which proved to be very successful. To each of several companies was assigned a certain rate with which it had had experience, and each was requested to present a short paper on the advantages or disadvantages of this form of rate. This plan resulted in bringing out a discussion of practically every form of rate in force in the state. An interesting feature was that almost without exception the writers favored some form of two-charge or three-charge rate in place of the older forms now in effect. The difficulty appeared to be in putting such rate into effect without causing dissatisfaction among consumers.

The following officers were elected for the year 1919-1920: President, H. L. Mann, treasurer Buffalo General Electric Company; first vice-president, H. W. Peck, vice-president Mohawk Edison Company; second vice-president, C. G. M. Thomas, chairman New York & Queens Electric Light & Power Company; treasurer, E. H. Rosenquest, president Bronx Gas & Electric Company; secretary, C. H. B. Chapin.

WHY COMMONWEALTH EDISON RATES WERE NOT RAISED

Conservative Financing, Economies Effected by Engineering, and Foresight in Purchase of Coal Lands Are Samuel Insull's Reasons

Speaking to the employees of the Commonwealth Edison Company, Chicago, on Oct. 30, Samuel Insull expressed a feeling of sincere pride that it had been possible for the company to withstand the strain imposed by war conditions without raising its rates. Conservative financing, which kept the interest rates paid by the company as low as possible; adoption and installation of modern and efficiently economical machines bought out of reserves built up for the purpose, and exercise of foresight in purchasing coal lands which then could be bought at comparatively low prices were the principal factors which in Mr. Insull's opinion made it possible for the company to continue to sell its products at the same rates when every other business in Chicago raised prices for its commodities.

Moreover, said Mr. Insull, even if increased costs of coal mining and transportation should result from the coal strike the Commonwealth Edison Company could withstand an increase in its fuel bill of from $500,000 to $700,000 because of the increased economies in generation which will be possible with new machinery now being installed. The coal strike could not affect the company immediately because it has its ample storage facilities well filled.

COMMERCIAL SECTION, N. E. L. A., HELD MEETINGS IN CHICAGO

Bureau and Committee Meetings Grouped Together, Oct. 21-24—More than 100 Members Present—Good Progress Made

What might be called a convention of the committees and bureaus of the Commercial Section of the National Electric Light Association was held in Chicago on Oct. 21-24. John G. Learned, chairman of the Commercial Section, arranged for meetings of the Lighting Sales Bureau, Merchandise Sales Bureau, Advertising and Publicity Bureau and for meetings of various committees during these four days. The plan proved very successful and brought together more than 100 commercial men from all sections of the country.

The executive committee of the Commercial Section concluded the conference when it went into session on Oct. 24 and reviewed the progress of each committee and made further plans for stimulating the activities of the section. John F. Gilchrist, past-president N. E. L. A. was present at this meeting and addressed the members on the possibilities of electrical merchandising. Martin J. Insull, first vice-president of the N. E. L.A., also joined the meeting and expressed keen appreciation of the work being done in the Commercial Section.

The wiring committee (R. S. Hale, Edison Electric Illuminating Company, Boston, chairman) was greatly stimulated in its work by the favorable decision rendered in the case brought against the N. E. L. A. for creating unfair competition by its stand in favor of the standardization of plugs and receptacles. Progress was reported toward the adoption of a universal plug to fit all appliances. The committee deemed it advisable to find out by actual test the relative merits of the different portable cords on the market. Manufacturers will be asked to submit samples of their cord with specifications, and the chairman was authorized to have these samples tested. Probably No. 16 stranded-wire cord, suitable for flatirons, will be tested first. It was suggested that the scope of the investigation include tests for tensile strength, bending, heating under overload, bending after heating, rubbing, etc.

Samples of all the different types of wiring used in this country and abroad are to be placed on exhibition at the national headquarters. The Commonwealth Edison Company furnished a board containing samples of all types of wiring used in Chicago. This will be sent to New York and other exihibits will be added as soon as possible. Two lectures are to be prepared on wiring methods, one for the benefit of contractors and one for the benefit of owners and architects. W. M. Ellis of the Building Managers' Association pointed out the desirability of being able to make extensions and changes in the wiring of office and other similar buildings without cutting into the fireproofings or going to a prohibitive expense. He recommended the use of lead-covered wire under safe conditions.

The Lighting Sales Bureau (Clarence L. Law, New York Edison Company, chairman) decided that inasmuch as industrial lighting was being featured so generally all over the country, a special effort would be made to promote home lighting by an appropriate exhibit and address at the next convention.

The Power Sales Bureau (R. H. Knowlton, United Gas Improvement Company, Philadelphia, chairman) completed its organization and made plans for its work.

Two sub-committees were appointed by the committee on compensation of salesmen (Adolph Hertz, New York Edison Company, chairman). One of these sub-committees was instructed to arrive at a basis for the compensation of sales department employees, from the position of counter clerk up, based on the time and selling ability required. The other sub-committee will report on the best method of compensating the salesmen.

It was decided by the "Electrical Salesmen's Handbook" committee (I. Lundgaard, Rochester Railway & Light Company, chairman) to revise the handbook. Part of the data will be put in a bound volume and loose-leaf pamphlets will be issued on special subjects.

The committee on education (Fred R. Jenkins, Central Station Institute, Chicago, chairman) was authorized to advertise the educational courses because the executive committee of the parent body had authorized the unrestricted sale of the courses.

A proposal made by the Advertising and Publicity Service Bureau (L. D. Gibbs, Edison Electric Illuminating Company, Boston, chairman) will, if carried out, keep the N. E. L. A. and the Society for Electrical Development from duplicating each other's publicity work.

The desirability of exploiting electrically equipped furniture was agreed upon by the Merchandise Sales Bureau (E. A. Edkins, Commonwealth Edison Company, Chicago, chairman). Through the efforts of two sub-committees—one on the attractive possibilities of electrically equipped furniture, and another to develop samples—it is hoped to have some pieces of this furniture on show at the next convention of the Grand Rapids furniture dealers.

The grouping of the committee meetings proved so successful that the plan will be continued, and the next group of meetings will probably be held in New York City during the first or second week of December.

PHILADELPHIA CONFERENCE ON ELECTRICAL FIRE HAZARDS

Subject Emphasized as of Vital Importance to Both Producers and Consumers—Causes of Hazard and Relation to Whole Problem

A conference on "electrical fire hazards" was held under the auspices of the Philadelphia Fire Underwriters' Association at Philadelphia on Oct. 23 and was attended by about 150 local wiring contractors and wiremen.

Washington Devereux referred to changes in electrical fire hazards in the past fifteen or twenty years and mentioned briefly some plans for the 1920 National Electrical Code. The subject was emphasized as of vital importance to both producers and consumers in the electrical field.

Mr. Devereux outlined what he considered a lack of extended discussion of the topic in the technical press generally and then proceeded to analyze electrical fire hazards from the wring contractor's standpoint under three heads, (a) short circuits, (b) leaks, and (c) contact of inflammable material with parts which have become overheated. Each of these three causes of fire hazard was defined and amplified in its relation to the whole problem. Experience seems to prove that protective devices usually open because of short circuits, but that a very large number of fires occur in spite of the protection afforded by these devices, owing largely to the fire starting before the arc of the short circuit is extinguished by the fuse or breaker. Illustrations of such fires were given. Reference was made to an early ruling prohibiting the use of rubber-covered wire in central-station wiring work. The change to slow-burning or asbestos-covered wire was followed by a greatly reduced fire hazard in central-station plants.

The fire hazard from leakage the speaker called one of the most treacherous. Examples of wood molding in which leaks between the wires were the cause of fires were exhibited, one case being due to a defective joint and a second to slow deterioration caused by dampness. In the latter case the fire started six years after the wiring was installed. Electrolytic leakage action was referred to as a source of danger in wood-molding work where water or dampness can reach the wires. Slate distribution boards were then referred to, as were the likelihood of short circuits in lamp sockets and a number of other common causes of fire hazard. Mr. Devereux emphasized the fundamental importance of looking upon the joint in the circuit as the weakest part of the whole problem of interior wiring work.

William McDevitt, chief inspector of the Philadelphia Fire Underwriters' Association, dealt with fire hazard from dust explosions and pointed out that this danger has been revived recently on account of certain conditions in manufacture. Mr. Devereux and Mr. McDevitt gave results based on experiences covering thirty years. Demonstrations of explosions with sawdust, starch, flour and sugar dust were made.

Mr. Devereux referred to explosions caused by inflammable dust settling on gas-filled lamps unprotected by vapor-proof inclosures. In one case the accumulations of dust on the lamp was caused by the peculiar shape of the type C bulb. Inclosures required from the standpoint of fire hazard in woodworking establishments were touched upon, and later Mr. McDevitt discussed gasoline vapor explosions.

The liberal regulations governing fire hazard in this country were referred to as one of the controlling factors which have promoted the electrical industry in the United States, and the early stringency of the rules in England was mentioned. That the situation in this country is no worse was attributed largely to the Board of Fire Underwriters. Mr. Devereux mentioned Rule 42 of the Code and spoke of the requirements for lighting in garages so as to avoid gasoline explosions. He touched on the matter of proper insulation and precautions to be observed in the transmission of power over long distances.

Relations of high-voltage lines to telephone circuits and the lightning protection problem were discussed at some length. Mr. Devereux called attention in particular to the alkali dust on high-voltage line insulators in the Far West and its effect on opening the breakers when current is first thrown on the line. Emphasis was placed upon the importance of heeding the rules for avoiding fire hazard in temporary work, and the suggestion was made that as much care be given to such work as to permanent work.

NEW PUBLICITY POLICY FOR ELECTRIC INDUSTRY

The Proposed Course of Action Is Predicated on Bringing Home to the Individual What Electricity Means to Him

At the meeting of the San Francisco Electrical Development League, Sept. 22, a new publicity policy for the electrical industry was outlined by A. E. Wishon, assistant general manager of the San Joaquin Light & Power Corporation, Fresno, Cal., and president of the Pacific Coast Section, N. E. L. A.

Mr. Wishon in a forceful speech proposed a transition from general to specific advertising methods to show the people the vital need for full electric power development in the West. He urged that each individual in the community be convinced of the definite financial value to him of such development.

NEW EDUCATIONAL COURSE ON CO-OPERATIVE LINES

Five-Year Course at Massachusetts Institute of Technology and General Electric Company Works Is Inaugurated

A new co-operative educational course in electrical engineering, in which the Massachusetts Institute of Technology and the General Electric Company are concerned, was scheduled to begin Oct. 6 at Cambridge. The length of the course is to be five years, the first two of which are identical with the regular institute course in electrical engineering, the remainder being divided between theoretical instruction at the institute and practice at the Lynn Works of the company. In order to provide sufficient time for the factory work, the regular four years' electrical engineering course at Cambridge is somewhat abridged, and the fifth year will virtually be of post-graduate character, emphasis being laid on the problems of administration, design and research. The classes will alternate in study at the institute and at Lynn, and the degree of master of science will be conferred upon completion of the course. Prof. W. H. Timbie is in charge of the course, which is specially designed to fit men for executive posts in the electrical industry.

INTERNATIONAL COMMISSION RESUMES WORK IN LONDON

Electrotechnical Body Representing Many Nations Holds First Plenary Session Since War —American Delegates Attend

(By Cable to Electrical World)

The American delegation of the International Electrotechnical Commission assembled at London on Oct. 18 and worked two days and nights on preparations for the meeting of the rating committee, which opened on Oct. 20 at the Institution of Civil Engineers at 11 a. m., twenty-two nations being represented. Sir Richard Glazebrook, chairman of the British national committee, was appointed chairman of all the working sessions of the committee and the commission.

The official opening of the fortieth plenary meeting of the commission occurred at 3 p. m. on Oct. 20, Maurice Le Blanc, president of the commission, presiding. The honorary secretary, Col. R. E. Crompton, who was detained to testify at a parliamentary commission regarding the invention of tanks, arrived at the close of the meeting and had a great ovation. The rating committee met both before and after the official opening meeting and also on Oct. 21. The American proposals were received with great interest, though considered somewhat revolutionary in their possible influence on rules already formulated and agreed upon at the Paris meeting last May.

The appreciative and considerate attitude of the delegates of all other countries toward American proposals was exceedingly gratifying and complimentary, especially in view of the fact that the proposals were not presented in time for consideration by the national committees in various countries. The American delegation was impressed by the necessity of more diligence at home in preparing and transmitting proposals in future Two. bulletins, containing rules previously reported by the rating committee and submitted for formal adoption by the commission, were amended acceptably, first, by confining their applicability to machines of not over 750 kva. and to all transformers not water-cooled; second, by making various changes in rules removing inconsistencies therein and also inconsistencies with present practice. At a working session of the commission on Oct. 21 committees, which in future will be termed advisory or consultative committees, were appointed on eight subjects, namely, nomenclature, rating, symbols, prime movers, aluminum, screw lamp caps and holders, charging plugs for electric vehicles, and classification of transmission and insulator voltages. The countries to be represented on each committee were designated. America is represented on all eight committees.

A banquet was tendered the delegates by the British national committee, which is a section of the British Engineering Standards Association, also by the Institution of Electrical Engineers and the British Electrical and Allied Manufacturers' Association.

On the evening of Oct. 21, Sir Richard Glazebrook presiding, an inspiring address on the influence of standardization upon economy in production and upon waste was given by Arthur J. Balfour, Foreign Minister, who had addressed the first plenary meeting, held in London eleven years ago. Able addresses were made by Maurice LeBlanc, president of the commission, and by the presidents of the national committees for France, Switzerland, Italy and America. A fine response was made by Colonel Crompton, the honorary secretary, who was enthusiastically acclaimed as the father of international standardization.

Manifest evidence was given at the banquet as well as at the various sessions that the commission meeting was timely and would bear valuable fruit. Every delegate was pleased over the renewal of activity, and it was felt that the meeting was sure to be a great success. Credit is due principally to the great ability, experience and tact of Secretary le Maistre, and especially to the indefatigable activity and energy of himself and his staff. Among matters specially emphasized at the working sessions was the importance of internationally acceptable definitions and a vocabulary for promoting clearness and facilitating international relations and understandings between national committees, not alone for interpretations of existing rules but also for discussion and formulation of new rules, thereby rendering co-operation more effective.

The closing meeting occurred on the afternoon of Oct. 22. It was then decided to increase the annual contributions of the national committees. Dr. C. O. Mailloux, president of the American committee, was unanimously elected president of the commission for the next period of two years. The invitation of the American committee to have the next plenary meeting in America next year was accepted unanimously and enthusiastically. A silver cup was presented to Colonel Crompton by Dr. Mailloux on behalf of all the delegates.

The work of the rating committee will continue for several days after the adjournment of the plenary meeting, at the request of the American delegation, to consider rules for larger machines, as well as dielectric tests, efficiency measurements and various new matters. The editing committee will also continue sessions to edit for immediate publication all rules and provisions adopted by the commission. A general desire was expressed by all the delegates to have the work of all committees pushed vigorously to make up for the time lost during the war.

RADIO CORPORATION OF AMERICA IS FORMED

New Company to Take Over Radio Rights of General Electric Company and Properties of the American Marconi Company

A new company, the Radio Corporation of America, has been formed to take over the radio rights of the General Electric Company. It has also proposed to the Marconi Wireless Telegraph Company of America to take over its patents and stations and some of its assets. Directors of the American Marconi Company have approved the arrangement and called a meeting of shareholders for Nov. 20 to pass upon it finally.

Edward J. Nally, vice-president and general manager of the American Marconi Company, said in a statement:

The American Marconi Company has the disadvantage of having a substantial percentage of its stock held abroad, and because of patent agreements with the British Marconi Company, of having its operations limited in the United States.

The research laboratories and engineering force of the General Electric Company have been working for a number of years on radio matters, and radio apparatus of great value has been developed, which was used by the government during the war for important communications.

ILLUMINATING ENGINEERING SOCIETY HAS GOOD MEETING

Automobile Headlighting, Street-Lighting Practice, Lighting Codes and Industrial Lighting Progress Among Subjects Discussed

For the first time in about eight years the Illuminating Engineering Society this year held its convention in Chicago, on Oct. 20 to 23 inclusive. A later date than usual was chosen in order to permit delegations to visit the Chicago Electrical Show. This arrangement made the convention fall after the newly elected president, S. E. Doane, had assumed control of the society's activities, but on account of the special circumstances the convention was conducted by the retiring president, G. A. Hoadley, and his administration. In the first three days there were four business and four recreative sessions.

The more serious meetings were devoted to the reading and discussion of about twenty papers and to reports on committee activities, outdoor lighting and photometry, industrial lighting codes and the commercial aspects of illumination. Interspersed were the entertainment features, which included the president's reception and dance, a visit to the Chicago Electrical Show and a banquet under the guidance of R. F. Schuchardt.

The part that the society has played in the development of the electrical industry during the past twenty-five years was brought out in the address of welcome delivered by Louis A. Ferguson, vice-president of the Commonwealth Edison Company.

In his response on behalf of the visiting members and their friends, L. B. Marks of New York said that Mr. Durgin's success in showing how production could be increased by proper illumination had prompted some one to ask, "How can we 'Durginize' our factories?" This referred more particularly to the present, but the part played by the society during the war was outlined in detail by George A. Hoadley of Swarthmore, Pa., in his presidential address.

The President's Address

President S. E. Doane, when callled to address the convention, said that electric light has been too generally used as janitor service when it should be treated as an instrument of production. As nearly as can be estimated 65 per cent of the lamps manufactured in this country are used in places where a better knowledge of illumination would result in the adoption of higher lighting intensities.

C. A. Law reported the finances of the association to be in a stable condition. The budget for the year had not been exceeded, and the membership now numbers about 1150.

A very complete account of the year's advances in gas and electric illumination was given in the report of the committee on progress by Francis E. Cady, the chairman. The ensuing discussion was participated in by Preston S. Millar, New York City; D. McFarlan Moore, Harrison, N. J.; James R. Cravath, Chicago; C. M. Mason, Los Angeles; Dr. George A. Hoadley, Swarthmore, Pa.; George H. Stickney, Harrison, N. J.; Charles A. Bond, Philadelphia, and Dr. Louis Bell, Boston. L. C. Porter, Harrison, N. J., also suggested that the Illuminating Engineering Society coöperate in working out the illumination problems of the Society of Motion-Picture Engineers.

Automobile Headlighting Practice

The recommendations of the committee on automobile headlighting, of which Dr. Clayton H. Sharp is chairman, have been adopted without change by the States of New York, Connecticut and Pennsylvania. The detailed specifications were given in the committee report. This was supplemented by an interesting inside demonstration of the practical application of the committee's ideas. Those who discussed the report seemed to agree that the use of approved equipment does not help much unless it is properly installed on the cars. Then provision should be made in garages or elsewhere to test headlamps as actually used and as often as the experience of service demands. It was also said that the public soon became educated to know proper headlighting when machines are stopped and the occupants are told how or by whom the headlamps can be adjusted. This is done by proper inspection in Connecticut and Pennsylvania. The report was discussed by H. P. Gage of Corning, N. Y.; L. C. Porter, George B. Nichols, Albany, N. Y.; Norman Macbeth, New York; Ward Harrison, Cleveland; F. H. Murphy, Portland, Ore.; L. C. Norton, Los Angeles; H. A. Hoeveler, Madison, Wis.; Charles A. Bond, James R. Cravath and Dr. Louis Bell.

Developments in Street Lighting

The best part of an entire session was devoted to the general subject of street lighting. The most interesting fact brought out was pointed to by Dr. Louis Bell when he opened the discussion—that large incandescent lamps and arc lamps have been developed side by side. Some years ago many thought that the day of the arc lamp had passed, but now this lamp is more efficient than ever and is holding its own where large units and high intensities are required. Many doubts have been expressed as to the practicability of using low-mounted units for street lighting, but a successful installation of this description has been completed on the Kensico Dam heading and was made the subject of a paper by C. A. B. Halvorson and A. B. Oday.

Developments in electric street-lighting units were described in a paper by A. D. Cameron and C. A. B. Halvorson. They pointed out that the periodical trimming required by arc lamps was because the lamps were cleaned more often than is sometimes the case with incandescent-lamp installations. Incandescent street lamps are often allowed to get so dirty that their efficiency is greatly impaired. False economy in maintenance may cut in half the utility of the entire street-lighting investment. It was said that much more attention is paid to the proper maintenance of street-lighting equipment in Europe than in this country.

F. V. Westermaier's paper on "Recent Development in Gas Street Lighting" was included in this group of papers, which were discussed by Frank R. Mistersky, Detroit; Ward Harrison, Charles M. Cole, Boston; Charles A. Bond, William P. Dempsey, New York; George B. Cousins, Toronto; C. M. Masson and others.

Capt. Chester Lichtenberg of the United States Army read a paper on military searchlamps, in which he described different types of equipment used during the war, how they were applied and tested. Dr. Arthur H. Comp-

ton had prepared a paper on a photoelectric photometer, and Frank A. Benford one on the use of universal photometric integrators. Owing to lack of time at this session these two papers were ordered printed in the *Transactions* without being read.

Ward Harrison presented a paper in which he stated that independent observers had been found to agree closely on the relative amount of glare from different lamps. Proceeding on the theory that the human eye could estimate the relative discomfort caused by poor light sources, he has constructed a simple device by the aid of which lighting installations can be roughly classified according to the sensation of glare. James R. Cravath, Arthur J. Sweet, Milwaukee; Prof. F. C. Caldwell, Columbus, Ohio, and George P. Stickney discussed the paper at some length.

Discussion of Lighting Codes

On account of the present interest throughout the country in lighting codes, a symposium was prepared in which information was given on methods of compiling a code, the problem of having a code adopted by the authorities, the administration and application of codes already in effect, and the results accomplished by codes in improving lighting conditions in factory and industrial establishments. The men who spoke on one or more phases of this subject and the states represented are as follows: John A. Hoeveler, Wisconsin; John J. Vogt, New York; A. L. Howell, representing Rowland H. Leveridge, New Jersey; J. S. Spicer, Pennsylvania; F. H. Murphy, Oregon; R. Meyers, California; Prof. F. C. Caldwell, Ohio, and Dr. Louis Bell, Massachusetts.

In addition, A. H. Taylor read Dr. M. G. Lloyd's adddress on some of the results obtained through the application of the lighting sections of the National Safety Code, and R. E. Simpson, from the viewpoint of the insurance company inspector, said that the experience of the Travelers' Insurance Company indicated that greater attention must be given to reflector equipment, especially on drop lights, and to the lighting of stairways, passages and other unfrequented places.

Prof. C. E. Clewell, Philadelphia, presented a written discussion on the subject, which was also discussed by L. B. Marks, New York; C. A. Klise, Chicago; Dr. E. P. Hyde, Cleveland, and George B. Nichols, Albany, N. Y.

R. M. Searle, Rochester, N. Y., suggested the use of some novel and little-known lighting applications, in a paper on opportunities for extending lighting business. One of the biggest fields was said to be in daylight window lighting. N. Macbeth said in the course of the discussion that daylight window lighting requires five times the recognized standard lighting intensities. The paper was also discussed by Louis Freigman, Chicago; J. D. Israel, Philadelphia; James R. Cravath, Charles D. Bond and J. L. Minick, Altoona, Pa.

Lighting Conditions in Great Britain

"Lighting in England" was the title of a paper by F. W. Wilcox of London, England. General lighting conditions were said to be much worse there than here, but, on the other hand, there are some features of English practice which might be adopted with advantage in this country. In the discussion of the paper Edwin D. Tillson, Chicago; Frank H. Bernhard, Chicago; George S. Stickney and Samuel G. Hibbin took part.

Industrial Lighting Conditions

The results of what is probably the most complete and comprehensive survey of industrial lighting conditions ever undertaken were given in a paper by R. O. Eastman, Cleveland. He said that only about 5 per cent of all the executives called on had ever been approached by any one interested in improving their lighting installations. About 70 per cent of the concerns purchased their lighting service, but less than 10 per cent went to central stations for advice or help in their lighting problems. Following the reading of the paper a lively discussion was entered into by George H. Stickney, S. B. Vincent, Philadelphia; F. W. Wilcox, Mr. Merrill, Milwaukee; A. B. Spaulding, Jersey City; M. Luckiesh, Cleveland; Earl A. Anderson, Cleveland; Norman Macbeth and others. This closed the business sessions of the first three days.

General Lighting Practice the Subject of Concluding Session

The final session was given over to paper and discussions on general lighting practice. The meeting was held on Thursday, Oct. 23. The interest of the members and the average meeting attendance of 125 to 150 persons were maintained to the end. Greetings from Japan were delivered to the society in a few well-chosen words by Prof. Hitaro Yamakawa of the Imperial University of Tokyo and past-president of the Illuminating Engineering Society of Japan.

The first paper of the day, written by O. R. Hogue and J. J. Kirk, Chicago, dealt with the factory lighting problem from the central-station viewpoint. The authors outlined the experience of the Commonwealth Edison Company, Chicago, and said that gratifying results had been obtained in large and small factories by installing, renting and maintaining the lighting system best suited to the conditions of each particular customer. The paper was discussed at length by W. K. Harrington, New York; John A. Hoeveler, Madison, Wis.; Prof. F. C. Caldwell, Calumbus, Ohio, and Albert L. Arenberg and Mr. Johnson, Chicago.

Some artistic interiors which had been illuminated without the use of pendent ceiling fixtures were shown and the methods of lighting described in a paper presented by Augustus D. Curtis and J. L. Stair of Chicago. The discussion of the paper was taken up by F. W. Wilcox, London, England, and A. L. Powell, Harrison, N. J.

The effect of walls and floors on the illuminating of rooms was dealt with in two papers. One was by Ward Harrison and Earl A. Anderson of Cleveland, and the other paper, which was written by Van Rensselaer Lansingh of Cincinnati, was read by W. F. Little of New York. There was a considerable difference in the results shown in the two papers. This was attributed to the fact that the Harrison and Anderson tests were made with an even intensity all over the plane of illumination, while in the Lansingh tests the rooms were illuminated from the center so that the lighting intensities on different parts of the working plane varied by four to one or more. Both papers were discussed by A. H. Taylor, Washington, D. C.; J. L. Stair; Norman Macbeth, New York, and by A. L. Powell.

At the close of the convention ex-President George A. Hoadley handed the gavel to President S. E. Doane, whose administration took over the general work of the society on Oct. 1.

BOSTON ELECTRICAL MEN MEET TO DISCUSS SALES POLICIES

Importance of Knowing the Facts Before Judging Merchandising Policies Emphasized at City Club Luncheon

Forty-two leading electrical contractor-dealers, jobbing-house, central-station and merchandising representatives assembled at the Boston City Club on Oct. 16 to listen to addresses on sales policies by C. Ernest Greenwood, superintendent of the appliance department of the Edison Electric Illuminating Company; George H. Guest, head of electrical sales Jordan Marsh Company, Boston; Clifton R. Hayes, president New England Section, National Electric Light Association, and Mr. R. Griffeth, General Electric Company, Boston. The meeting was signalized by a frank recognition of the mutual dependence of all branches of the electrical industry and by a clear setting forth of the importance of learning facts regarding sales policies before attacking them. The speakers were cordially received and were given a unanimous vote of thanks at the close of the meeting.

Mr. Greenwood pointed out that there is no industry offering greater opportunity for co-operation than does the electrical field. "Know the facts" is the all-important point, for lack of knowledge and misinformation are the causes of most of the misunderstandings between central station and contractor in recent years. Some of those engaged in the wiring business and classed as contractors have been so busy with their work that they have failed to keep in touch with the progress of central stations along the lines of co-operative development. Often statements indicate a complete lack of knowledge of present conditions and opinions are formed on the basis of what practice might have been a few years ago.

A prominent contractor-dealer. Mr. Greenwood stated, recently referred to the Edison company's lamp renewal policy as an example of "cut-throat" methods. Most of the trouble with that policy, the speaker said, is due to the misnomer "free renewal." The contractor sells lamps at so much apiece; the central station sells at "cents per kilowatt-hour use" and gives no lamps away without a return in the rate. There is a strong tendency in the country to sell the contractor's way, but the substitution in large companies means vital changes, a very important one being a readjustment of rates, and other modifications of practice which cannot be granted just for the asking.

President Hayes of the New England Section pointed out the desirability of the contractor-dealer's learning the whys and wherefores of the central-station sales policies. He emphasized the field of service peculiar to the contractor and said that ultimately the expansion of electrical merchandising would probably make it unnecessary for the central station to sell electrical commodities. Intensive development of service opportunities along existing lines of central-station supply is essential to-day, in view of the cost of new construction.

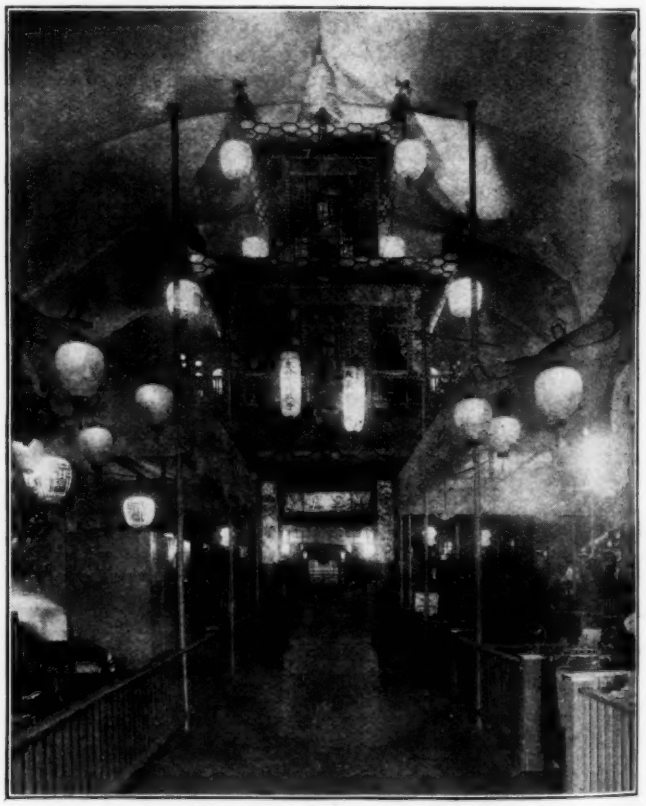
Mr. Guest emphasized the necessity for sound merchandising along the line of handling only thoroughly acceptable goods, maintaining prices, allowing adequately for overhead charges and offsetting the latter by frequent turnovers. He intimated that at present the retail profit on electric washing machines is unsatisfactory, and urged either a lower manufacturer's price or an increased retail price.

An aggregate of 15,000,000 unwired houses exist in the country to-day, according to Mr. Griffeth, who estimated that the sales of vacuum cleaners this year will treble those of 1918, that washing-machine sales will quadruple and heating-device sales be five time those of last year.

CHICAGO ELECTRICAL SHOW ATTRACTS MANY MEETINGS

Illuminating Engineers' Society, Illinois Contractors, Illinois Electrical Association and N. E. L. A. Committee Meetings Largely Attended

The Chicago Electrical Show has caused many state and national organizations to hold meetings in Chicago. Engineers from Japan, England and all sections of this country attended the thirteenth annual convention of the Illuminating Engineering Society on Oct. 20 to 23. This convention attracted the most out-of-town people, but the Illinois Electrical Contractors' Association, the



AN AISLE IN THE CHICAGO ELECTRICAL SHOW

Illinois State Electrical Association and committees of the Commercial Section of the National Electric Light Association also brought a goodly number of visitors to the city and to the electrical show.

The Western Society of Engineers' drive to get 2000 new members in one week was a success. More than 2000 applications for membership were turned in and more are still being received.

On Oct. 21 Gen. George H. Harries addressed the Illuminating Engineering Society and the Electric Club.

MANUFACTURERS ASSEMBLE TO DISCUSS EXPORTATION

E. M. Herr Points Out Need for Development of Diplomatic Service Equal to Great Responsibilities Which Will Devolve Upon It.

Among those who took an active part in the convention of the American Manufacturers' Export Association in New York on Oct. 16 and 17 were E. M. Herr, president Westinghouse Electric & Manufacturing Company; M. A. Oudin, vice-president International General Electric Company, and W. W. Nichols, Allis-Chalmers Company.

Mr. Herr, who presided over the session on "our diplomatic, consular and commercial services under new world conditions," said that "our first and most pressing need in this connection is in development of a diplomatic service which shall be equal to the tremendous responsibilities that will devolve upon it. In the light of what some of our foreign representatives have done in the past, and despite obvious handicaps and disadvantages, it is difficult to condemn the system of which they were a part as incompetent and unworthy of a great country, yet I think these men would be the first to agree that our nation and our government have been shamefully negligent and short-sighted in provision for our diplomatic needs.

"No American ever returned to his country, after a visit to other lands, without bringing home the conviction that the United States was a first-class power at home and a fifth-class power abroad. He found the representatives of the United States housed in rented quarters, usually in some out-of-the-way section of the city, and found the representatives themselves, in nine cases out of ten, unfitted in talent and training for the offices they filled."

Mr. Oudin presided over the session at which Russian conditions were discussed. In his remarks he summed up the general situation with reference to our future trade with Russia, urging economic assistance to the forces opposing Bolshevism.

ALL-ELECTRICAL CHRISTMAS IS PLANNED FOR THIS YEAR

Society for Electrical Development Announces Campaign with Sales and Advertising Material to Direct Buyers to Electrical Opportunities

The Society for Electrical Development has announced a campaign for an all-electrical Christmas this year. Representatives of the society have just completed a survey covering sixteen states and the Province of Ontario, Canada, during which electrical conditions in every branch of the industry were studied at close range. In most cities the contractors, dealers, jobbers and manufacturers reported the greatest volume in their history.

Manufacturers and distributors of electrical specialties, particularly, are far behind on orders, and dealers in these devices are finding ready sale. As one retailer expressed it: "For the first time in the history of electrical appliance selling in this city people are coming into the store to buy large and expensive specialties which heretofore we had to go out and sell with the hardest kind of selling."

Based upon this information, the society has prepared complete and comprehensive sales and advertising material for holiday selling. This material will comprise a beautiful poster in many colors, colored leaflets, envelope inclosures, cards for counters, cars and windows, form letters and various other advertising matter. It is planned to distribute this co-operative help to the trade at large, as in the past society campaigns.

AMERICAN WELDING SOCIETY HOLDS ITS FIRST MEETING

Steps in Organization of Society Traced by President C. A. Adams—First Rational Theory of Metallic Arc Welding Presented

About 200 persons interested in welding methods and practices attended the first regular meeting of the American Welding Society, held in New York City Oct. 24. Following an address by President Comfort A. Adams in which he traced the development of the society, several very interesting papers were presented on gas and electric welding, namely, "Gas Welding During the War," by H. S. Smith; "Electric Resistance Welding," by P. T. Van Bibber of the Thomson Welding Company; "A Theory of Metallic Arc Welding," by Prof. R. G. Hudson, Massachusetts Institute of Technology, and "Repairing a Lighthouse," by J. H. Deppeler.

Professor Adams pointed out that while the American Welding Society now covers both gas and electric welding, it had its inception in a committee which was formed in 1917 to assist the Council of National Defense in solving its shipbuilding problems. From its initial status the organization passed through various stages of existence and attachments, accomplishing such work as assisting in the development of spot welding to the point where it almost supplanted rivets in ships and fostering the development of cast anchor chain. The first financial support was obtained from the Emergency Fleet Corporation; this enabled the carrying on of research work. After the war need of the organization was over the founders decided that that it would be a pity to discontinue the work which had been so successful, so funds were obtained from manufacturers and users of welding apparatus to support a permanent organization and the American Welding Society was founded. The Bureau of Welding was also formed as a closely allied body to consider only the research side of welding, and it is supported in such a way that it is under no obligation to any manufacturer.

The paper on resistance welding referred to different forms of welding in which a plastic condition is produced on the surfaces to be welded by contact and conductive resistance. Butt and lap welding were considered, but particular attention was given to spot welding, many interesting results of experience being cited, such as metals that can be welded, thicknesses of metal that can be handled, current required, energy consumption, etc.

The paper by Professor Hudson, in President Adams' opinion, presented the first rational theory of metallic arc welding. As a result of studies made by means of motion pictures, spectrographic analysis, ground-glass and micrographic observations, it was concluded that metal globules are projected through the arc onto the surface to be welded by the expansion of gases formed in the metal by the intense heat of the arc.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Changes in the American Welding Society.—J. H. Deppeler of the Metal & Thermit Corporation has been elected a vice-president of the American Welding Society, and P. F. Willis, president of the Henderson-Willis Welding & Cutting Company, has been elected a director of the society.

Wireless Telephones on Island of Hilo.—It is announced that the island of Hilo, 175 miles from Honolulu, is being equipped with wireless telephones, several dozen of which are being distributed among big business houses, each of which thus has a direct connection with Honolulu, the chief island port.

Public Utilities Law Agitated for Texas.—Many cities and towns of Texas have through their municipal officers joined in a movement to bring about the enactment of a public utilities law by the Legislature. While a few members of the League of Texas Municipalities have voiced disapproval of the proposed law, the opposition from this source is not regarded as being of much moment. A business session of the league was called to be held at Dallas to receive the report of a committee appointed at a recent meeting in Austin to draft a regulative measure. At the Austin meeting the proposition was thoroughly discussed. Representatives of fifty-two cities were present and letters were received from many more who could not attend.

Electric Power in New Catskill Water-Tunnel Construction. — The principal features of the Schoharie Development, which is to add 250,000,000 gal. per day to the Catskill water supply of New York City, are the Schoharie reservoir, formed by the construction of the Gilboa dam at Gilboa, N. Y., and the Shandaken tunnel, by which the waters of Schoharie Creek are conveyed to the Esopus Creek and the Ashokan reservoir. With the completion of the shafts of the tunnel there is at present a lull in the activities of this work, awaiting the completion of a high-power electrical transmission line which is to furnish power for the future tunnel work. The energy (three-phase, 60-cycle) is to be secured from the Central Hudson Gas & Electric Company, Poughkeepsie, and requires the construction of a transmission line 48 miles long, 30 miles of this line being required to bring the energy to the southerly end of the work. Energy will be delivered at the southerly end of the work at 33,000 volts, and at each shaft or other point of attack a substation will reduce this to 440 volts. All plant machinery will be driven by electric motors especially adapted for this purpose. The maximum demand is 3000 kw. per hour. In addition to the use by the tunnel contractor of electric power, negotiations are in progress to furnish energy for use in the construction of the Gilboa dam. This will necessitate the construction of about 4 miles of additional transmission line.

Pittsfield G. E. Works Welcome Western Massachusetts Engineers.—One hundred and thirty-five members and friends of the Engineers' Society of Western Massachusetts were recently guests of the Pittsfield works of the General Electric Company, the general manager, C. C. Chesney, acting as host. The party made a tour of the factories under the convoy of about thirty guides and later assembled at the Maplewood Hotel for luncheon. An address was given by Mr. Chesney, who reviewed the early history of the plant and its growth. C. E. Newcomb of Holyoke, Mass., paid a high tribute to the constructive work of Mr. Chesney and his associates in building up the city of Pittsfield through its largest industrial development. Calvin W. Rice, New York, secretary of the American Society of Mechanical Engineers, spoke of the future importance of engineers in the conduct of public affairs, and G. Faccioli, consulting engineer, Pittsfield works, emphasized the development and tendencies of high-tension transmission. Sidney W. Ashe, General Electric Company, gave an interesting illustrated talk upon the Americanization work of the past six years in the Pittsfield works. Other speakers were W. E. Holmes, secretary of the society, Springfield, Mass.; E. E. Lockridge, chief engineer Springfield Water Board, and C. H. Wright of the Governor's Council.

Kentucky & West Virginia Power Company.—The Kentucky & West Virginia Power Company, incorporated in Kentucky in July, 1919, owns and operates two electric generating stations adjacent to coal mines at Hazard, Ky., and Sprigg and Logan, W. Va. It also owns practically all the common stock of the Logan (W. Va.) County Light & Power Company. The company supplies electric light and power in bituminous coal fields of southeastern Kentucky and western West Virginia and adjacent districts. The combined population of the districts served is about 110,000. The company is supplying under long-term contracts approximately 46,368 hp. in motors and at least 18,000 hp. additional will be added in the next twelve months. Coal is conveyed by mine cars directly to the power houses. The combined physical property includes three modern stations having a rating of 33,000 hp. including 8000 hp. in turbines already purchased but not yet installed. Estimated operating revenue for the year ended July 31, 1920, is $979,000. The president of the company is R. E. Breed, president American Gas & Electric Company. H. T. Hartman is vice-president and general manager. The capitalization is $3,000,000 common stock, of which $2,000,000 has been issued; $3,000,000 7 per cent preferred, of which $2,000,000 has been issued, and $20,000,000 of first mortgage 6 per cent bonds, of which $1,400,000 have been issued.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Philadelphia Section, I. E. S.—Dr. George A. Hoadley of Swarthmore College, past-president of the Illuminating Engineering Society, and S. E. Doane of the National Lamp Works, the present president of the society, were on the program to speak at the Oct. 17 meeting of this section.

Engineers' Society of Milwaukee.—The Milwaukee Section of the American Institute of Electrical Engineers was given charge of the Oct. 15 meeting of this society. The program included an illustrated talk on "Some Methods of Submarine Detection" by Prof. Max Mason, University of Wisconsin.

Illinois Electrical Contractors' Association.—At the meeting held by this association in Chicago on Oct. 16 and 17 it was decided that the association should take some action toward making every contractor a dealer and to help improve members' credit. Plans were made to put a man in the field to study conditions in different localities throughout the state.

Ohio State Convention of Engineers and Architects.—Following is the program of papers of the Ohio state convention of engineers and architects, held in Columbus, Ohio, on Oct. 14 and 15: M. O. Leighton, consulting engineer, Washington, D. C., "The Proposed National Department of Public Works"; Willard Beahan, New York Central Railroad, Cleveland, Ohio, "Relation of the Engineer to the Employer"; Dr. F. H. Newell, department of civil engineering, University of Illinois, "Co-operation Among Engineers and Architects"; Charles W. Baker, consulting editor *Engineering News-Record*, "Compensation of Engineers and Architects," and Gardner S. Williams, consulting engineer, Ann Arbor, Mich., "Registration of Engineers and Architects."

Public Ownership Conference.—In Chicago on Nov. 15, 16 and 17 there will be a public ownership conference. A call and proposed program has been issued by the Public Ownership League of America, 1439 Unity Building, Chicago. About forty different labor, farmer, civic and other bodies have joined in the call. The general purpose of the conference, as stated in the call, is to study the problems of public ownership, to get the ideas of the most careful and competent utility experts in America, to hear the methods and plans of those who have made a success of public ownership in this and other countries, and to devise ways and means for the advancement of the public ownership, efficient operation and democratic control of public utilities.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

A. L. WALLIS, formerly assistant auditor of the Bloomington & Normal Railway & Light Company, Bloomington, Ill., has been placed in charge of a new commercial department.

G. T. SEELEY, assistant general manager of the Chicago Elevated Railroads, has resigned, effective Dec. 1, to become vice-president and general manager of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio.

MILTON H. WAGNER, electrical engineer on the staff of the Bureau of Standards, Washington, D. C., resigned Aug. 25 to become associated with the Charles M. Kelso Company, industrial engineers and contractors, Dayton, Ohio, as manager of the electrical department.

N. J. BUTLER, who has been appointed superintendent of the electric light and power department of the Bloomington & Normal Railway & Light Company, Bloomington, Ill., takes the place of C. Frank Snyder, who recently died. Mr. Butler has been a member of the engineering staff of the company for several years, in charge of meter testing.

HERBERT J. FLAGG, formerly a captain in the Coast Artillery, has been appointed chief engineer of the Public Service Commission of Washington. Mr. Flagg takes the place of D. F. McCurrach, who has resigned to enter private practice in appraisal work and rate investigations. Prior to entering the government service, Mr. Flagg had been a member of the engineering staff of the commission.

COL. T. H. DILLON, who has resigned from the Engineers Corps of the United States Army, has been appointed a professor of electrical engineering at the Massachusetts Institute of Technology. Colonel Dillon was graduated from the Military Academy at West Point in 1904 and was appointed to the Engineer Corps of the army. After some military duties he was assigned to the Engineer School of Application of the United States Army, from which he was graduated in 1907. Since then he has had a varied and notable engineering experience—in Cuba during the American occupation as assistant to the Director of Public Works; in the Philippines on the miljtary survey of the island of Luzon; at Portland, Ore., in charge of the construction of the Dalles-Celilo Canal around the Dalles of the Columbia River and the roads in the Crater Lake National Park. He then was assigned to Panama and made electrical engineer of the Panama Canal and superintendent of the Gatun locks. Here he was also in charge of engineering in the locks division and the hydrographic division. In France Colonel Dillon was deputy chief engineer of the First Army of the American Expeditionary Forces in charge of the mechanical and electrical work, water supply, general construction, army shops and engineers' supplies. After the armistice he was made deputy to the chief of the Board of Damages in Allied Countries. At the Massachusetts Institute of Technology Colonel Dillon will make a specialty of instruction in the problems of electric railroads, including tramways and electrification of steam railroads, and in the problems of power transmission.

DR. EDWIN F. NORTHRUP has felt obliged, on account of the pressure of his scientific work and of duties connected with the Pyrolectric Instrument Company, Trenton, N. J., and the electric furnace development work for the Ajax Metal Company of Philadelphia, in which he is engaged, to decline the invitation tendered him to take the chairmanship of the electrochemical and electrometallurgical committee of the A. I. E. E. for the following year. Dr. Northrup, who is a member of the faculty of Princeton University and president of the Pyrolectric Instrument Company, was born in

E. F. NORTHRUP

1866. He was graduated from Amherst in 1891 and received his doctor's degree in physics from Johns Hopkins in 1895. He has been actively engaged ever since on the border line between pure physics and electrical engineering and in recent years more especially in electrothermics. In this field he has made an extensive study of the electrical properties of matter at high temperatures and has published numerous papers. For four years he was engineer for the Rowland Printing Telegraph Company, being awarded a bronze medal at the Paris Exposition in 1900 for his contributions to the Rowland telegraph system. From 1903 to 1910 he was secretary of the Leeds & Northrup Company and was engaged in the designing and marketing of many of the instruments made by this company. He patented a number of measuring instruments of original design. He became assistant professor of physics at Princeton University in 1910, and with the exceptional facilities found there in the Palmer Physical Laboratory he was enabled to carry on experimental work which resulted in the publication of more than forty papers. He has written two books, one "Methods of Measuring Electrical Resistance" and the other "Laws of Physical Science." The Franklin Institute awarded him the Edward Longstreth medal in 1912 for his experimental investigations on fluid vortex motions and the Elliott Cresson medal in 1916 for his work on the conductivity of metals at high temperature. He is the inventor of the Northrup-Ajax high-frequency induction furnace, the pyrovolter and other measuring instruments which operate on a new principle. Besides being a member of a number of prominent scientific bodies he is a fellow of the A. I. E. E. and also of the American Academy of Arts and Sciences.

VICTOR BAGLEY, heretofore superintendent of the Brunswick district served by the Central Maine Power Company, Augusta, Me., has been appointed construction superintendent of the company. Mr. Bagley will have charge of the construction of transmission and distribution lines and the maintenance work in connection therewith. Howard C. Campbell, who for several years has been assistant to Mr. Bagley, now becomes superintendent of the Brunswick district.

W. J. CANADA, recently assistant to the president of the American International Shipbuilding Company, Philadelphia, has joined the headquarters staff of Stone & Webster at Boston, Mass., and will be associated with W. H. Blood, Jr., in special reports and other work for the firm. Mr. Canada was for a time electrical engineer with the insurance interests in the Rocky Mountain territory, with headquarters at Denver, Col. In 1913 he entered the employ of the Bureau of Standards, Washington, D. C., and was active in the compilation of the National Safety Code as assistant to Dr. E. B. Rosa. In 1917 he went to Hog Island as assistant to the general manager of the American International Shipbuilding Corporation, later becoming assistant to the president. Mr. Canada is known throughout the country as an authority upon fire and accident prevention from the electrical standpoint.

Obituary

ARCHIBALD A. CHRISTIE, sales manager for the Mitchell-Vance Company, New York, manufacturer of lighting fixtures, died Oct. 10 after a short illness. Mr. Christie was forty years old.

WILLIAM F. SOFFE, vice-president and general manager of the Inland Electric Company, Chicago, died on the morning of Oct. 9 from meningitis arising from an injury received on a recent hunting trip. Mr. Soffe was thirty-two years old. He was formerly with the Hunter Manufacturing Company and in 1917 became connected with the United States Shipping Board, where he served as assistant director of purchasing electrical supplies.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

A BIG ELECTRIC HEATER SEASON IS ANTICIPATED

Manufacturers Have Increased Their Capacity and Feel that They Will Be Fortunate if They Can Supply the Demand

Manufacturers of electric projector-type heaters expect an especially good season. Factory capacities have been increased in instances up to 25 or 30 per cent above last year's production. The general impression among producers is that they will be fortunate indeed if they can produce sufficient heaters to satisfy the demand. The impending coal strike undoubtedly has had considerable to do with the recent growth of optimism in this field.

After last winter's open season jobbers as a rule had rather large stocks of heaters to carry over, and the outlook for this winter's business was not too hopeful. Late last spring many jobbers were of the opinion that they would not put in early season orders but would work off present stocks to some extent before replenishing. To all appearances, however, manufacturers have received sufficient encouragement from jobbers to warrant them even in preparing for increased business. Prices are in general higher than they were a year ago, and with the present attitude of labor it would not be surprising to find heaters manufactured later in the season carrying even higher prices. As late as the end of October shipments were coming through to jobbers in good shape, but it was too early to predict how shipments would run on orders placed later in the season. The conditions of demand alone would control that.

TO PRODUCE MORE ARMORED CONDUCTOR IN COMING YEAR

Manufacturers of Steel Strip Cannot Supply Quantities to Satisfy the Heavy Demand of Jobbers for Stocks

Throughout the last six months jobbers of electrical supplies have complained of the acute shortage of flexible armored conductor and their inability to obtain stocks. It is true that there has been a heavy demand for this material because of the number of residences which are being constructed, many of which use this type of wiring, and the vast amount of reconstruction and recircuiting which has been and is still going on and which can virtually be ttken care of only by such material.

There is apparently no shortage of the wire used in this material, only of the steel-strip covering. Manufacturers of this steel strip are turning out all that the present capacities of their factories will permit. Where contracts have been taken to supply a certain quantity periodically to manufacturers of the finished conductor these contracts have been filled and a little more. To other customers who are not on contract the strip manufacturers are sending all of the material they can turn out. In one case there is a lack of the raw material for the strip because some furnaces were shut down during the steel strike. In general, however, supplies of raw steel are fair.

Manufacturers of flexible armored conductor have been adding from one to a dozen machines in an effort to increase their output and in turn are endeavoring tt secure more strip in order to take care of increased output. Demands on manufacturers of the finished conductor have been abnormal this summer, not, manufacturers say, because of an abnormal demand for the conductor, but they believe the jobbers are over-ordering. The indications are that many jobbers and contractors are expecting a continued heavy demand for flexible metallic conductor throughout the next year and in their endeavor to cover themselves on future stocks are ordering in greatly increased quantities. Consequently there is being shipped to them only a small proportion of their orders, but as large a proportion as the manufacturers can produce. On the other hand, it seems that jobbers did not order in advance sufficient quantities of this conductor to take care of the present demand; consequently manufacturers of the conductor, who might have increased the amount of their contracts, had no opportunity to order greater quantities from the strip manufacurers, who in turn were not permitted to increase their stocks of raw material in order to take care of this increased demand all along the line.

At present there seems to be no indication that the supply of flexible armored conductor will be any better in the next few months. One manufacturer is already booked to entire capacity for the next five months. On the other hand, one of the strip manufacturers is increasing his equipment so that by the middle of next year he will be able to take care of more than 100 per cent greater capacity than at present. As soon as the labor situation quiets down and the mills are permitted to produce on an enlarged capacity for 1920 manufacturers of flexible armored conductor believe that they will be able to take care of orders and satisfy the market as regards its current needs.

MARKET FOR TRANSFORMERS KEEPING FACTORIES BUSY

Deliveries of These Machines Are Reasonably Good and Prices Are Firm with Raw Materials. in Fairly Plentiful Supply

The demand for transformers has lately developed to a point where representative manufacturing interests are finding virtually their normal plant capacity absorbed by orders now on the books. The dullness of the market noted last spring (ELECTRICAL WORLD, March 15, 1919, page 550) has disappeared, and the development of central-station and transmission systems, combined with the growth of industrial reconstruction activities, has brought a very satisfactory business to transformer makers. Stock deliveries can still be made in the standard lines of moderate-sized units, and deliveries of four to five months are being quoted on special orders, say the 500-kva. rating and upward. The shortage of housing accommodations bids fair to have its influence upon the transformer market for some time, and as building operations increase this branch of the electrical industry will profit thereby.

So far the steel strike has not had much effect upon the manufacture of transformers. The makers looked well ahead in this connection, and in a representative case no less than six months' supply of steel is on hand. Shortages in special lines of steel may occur, but there appears little ground for apprehension at this writing that the production of standard lines of transformers will be curtailed at present. Labor is doing better work than for some time in this department, it is a pleasure to state; wages are being maintained at recent high levels, and in some establishments a spirit of co-operation is coming into play which promises much for the enduring prosperity of employer and employee. Porcelain is somewhat hard to obtain, but other insulating materials are plentiful. Some makers are employing steel cases to a greater extent than formerly, but cast iron is still favored in other quarters except on units for transcontinental shipment, where carload orders and costly freight rates render the lighter construction desirable.

At this writing rumors of early price advances are current, and some such movement would not be surprising in view of the retarded increases in price shown by transformers and other

electrical products compared with many other commodities. But while overhead costs have tended to increase slightly of late, material and labor costs have not as yet advanced to a point where a general increase in transformer prices among competitor manufacturers has been conceded by all to be necessary. A prominent manufacturer stated to a representative of the ELECTRICAL WORLD a few days ago that he could see no general price advance coming at this time, and there is good reason to believe that the growing volume of business and the tendency to eliminate unnecessary sizes and ratings are working to make it possible to hold prices fairly close to present levels.

GAS-FILLED LAMP PATENTS ARE SUSTAINED IN COURT

Judge Mayer Holds that Nitro-Tungsten Lamp Company Infringes the Langmuir Patent of the General Electric Company

A decision of great importance to the incandescent-lamp industry was handed down Oct. 27 by Judge Mayer in the District Court of the Southern District of New York in General Electric Company vs. Nitro-Tungsten Lamp Company. The fundamental Langmuir patent (No. 1,180,159, April 18, 1916) on gas-filled, or "type C," incandescent lamps was involved.

The main defense considered by the court was that the patent showed no invention over the known prior art. The tungsten lamp was old at the date of Langmuir's invention, and many years prior to that date gases, including nitrogen, had been tried as substitutes for the vacuum of the carbon lamp.

The court held that the co-ordination or relation of parts specified in the Langmuir patent constituted a "highly meritorious invention" and sustained claims 4, 5, 12 and 13. The court declined to pass on the remaining claims, which were not limited to tungsten, on the ground that it was unnecessary to decide their validity in this particular litigation.

Claim 12, one of the claims sustained by the court, reads as follows:

"12. In an incandescent lamp, the combination of the lamp bulb, a tungsten filament therein, and a gaseous filling, the effective diameter of the filament being sufficiently large and the heat conductivity of the filling being sufficiently poor to permit the lamp to be operated with a filament temperature in excess of that of a vacuum tungsten lamp operating at an efficiency of one watt per candle and with a length of life not less than that of such a lamp."

THE SOUTH EXPANDING AS SUPPLY JOBBING MARKET

Owing to High Prices Received for Farm Products, Especially Cotton, This Region Is Experiencing Record State of Prosperity

That the South is expanding rapidly as a market for electrical supplies is made evident by the number of branch houses established by jobbers recently in that section. The South to-day, owing largely to the high prices for farm products and more especially cotton, is in a more prosperous state than at any time in the past sixty years.

Among the electrical supply houses that have recently established Southern branches are the following:

The Western Electric Company has recently opened a branch house in Jacksonville, Fla., and another in Norfolk, Va., these two new branches giving the company a total of nine warehouses and branch houses south of the Ohio and east of the Mississippi.

The Carter Electric Company of Atlanta has established a branch warehouse at Savannah, and its Atlanta office reports that it is highly pleased with the showing that the branch has made. The formal opening was in July 1919.

The Fairbanks Company of Birmingham, a national concern, has added an electrical supply department to the other activities of both its Birmingham and its New Orleans offices and contemplates following up this move throughout all its branch offices in the United States.

The Interstate Electric Company of New Orleans will establish a branch house at Shreveport to handle the upper Louisiana trade.

Among the new jobbing concerns started up in the last twelve months might be mentioned the Florida Electric Company at Tampa, Fla.

HEAVY STORAGE BATTERY DEMAND FORESEEN IN 1920

Manufacturers Expected to Experience Difficulty in Producing Sufficient Batteries to Supply Automobile Demand

In view of the present outlook, storage battery manufacturers will be unable to meet the demands of the replacement and new car equipment market in 1920, according to F. A. Wilson-Lawrenson, vice-president of the Prest-O-Lite Company, in his address to New England dealers and service men at Boston, on Nov. 3. Mr. Wilson-Lawrenson said that the leading automobile manufacturers have submitted their production schedules for 1920 to battery makers and that the latter will be unable to supply the demand even with their plants running at full capacity. All storage battery makers will speed up their production in an effort to meet the increased demand. It is expected that the Prest-O-Lite Company will increase its production 150 per cent over that of 1919. It was urged that in order to conserve present storage batteries car owners be encouraged to take better care of their present equipment.

AUGUST ELECTRICAL EXPORTS REACH TOTAL OF $7,716,228

Figures for First Eight Months of Year Amount to $62,317,802, or at an Annual Rate Not Far Short of $100,000,000

Exports of electrical goods during August last amounted to $7,716,228, the third largest month on record. Battery, generator, insulated wire and motor shipments were large.

For the first eight months of the current year electrical exports have amounted to $62,317,802, or 60 per cent more than for the corresponding period of 1918. At the rate set up the first eight months the figure for electrical exports for the calendar year will not fall far short of the hundred-million-dollar mark.

Figures in the accompanying table were compiled by the Bureau of Foreign and Domestic Commerce:

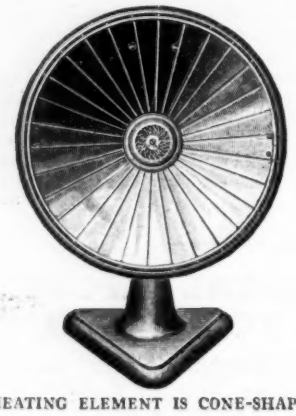
	August		Eight Months Ended August	
	1918	1919	1918	1919
Batteries	$ 252,529	$ 587,951	$ 2,068,187	$ 4,164,221
Carbons	123,926	106,823	1,009,435	1,034,411
Dynamos and generators	258,589	586,211	2,195,653	3,620,893
Fans	29,296	53,099	681,267	1,191,044
Heating and cooking appliances	79,954	124,668	422,232	1,095,415
Insulated wire and cable	677,485	741,443	3,665,799	6,991,392
Interior wiring supplies, including fixtures	108,386	166,499	1,003,240	1,583,793
Arc lamps	2,135	3,373	9,323	11,280
Carbon-filament lamps	5,474	10,135	62,091	127,475
Metal filament lamps	203,046	350,284	2,241,894	3,415,815
Magnetos, spark plugs plugs, etc	181,347	230,403	1,742,645	2,114,594
Meters and measuring instruments	189,393	268,448	1,362,019	2,061,100
Motors	573,547	729,608	4,899,746	7,111,752
Rheostats and controllers	17,408	45,833	154,855	336,790
Switches and accessories	159,811	356,676	1,549,917	2,432,471
Telegraph apparatus, including wireless	36,858	115,645	196,971	676,145
Telephones	259,185	324,755	1,999,846	2,491,201
Transformers	554,576	1,441,733	2,180,776	2,960,304
All others	1,627,980	2,472,641	11,165,198	18,897,678
Total	$5,340,925	$7,716,228	$38,610,824	$62,317,802

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Portable Radiant Heater

Landers, Frary & Clark of New Britain, Conn., have placed on the market the "Universal" radiant electric heater which is rated at 625 watts. It is of the round-reflector type and uses a cone-shaped heating unit which is replaceable. The polished coppered reflector is 12½



HEATING ELEMENT IS CONE-SHAPED

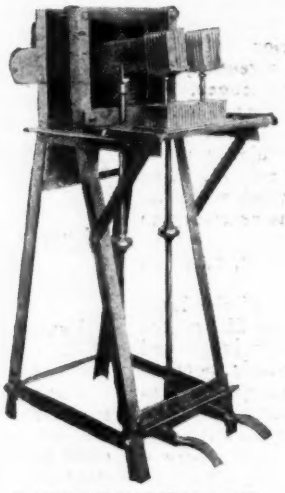
in. (32 cm.) in diameter and is adjustable to any angle. It is mounted on a heavy triangular base and has a strong wire guard that can be removed to clean the reflector. The heater has a verde antique finish and an ebonized handle for carrying. It is 20¼ in. (51 cm.) high and weighs 6½ lb. (3 kg.). A connecting plug and 8 ft. (2.4 m.) of heater cord are supplied.

Rapid Electric Rivet Heater

An electric rivet heater has been developed by the General Electric Company of Schenectady, N. Y., which claims for it a number of advantages, including localizion of the heat energy in the rivet, better heat regulation in proportion to the quantity of rivets used, cleanliness and minimum of scale formation. The rivet is heated from inside out, giving more uniformity of heat and better upsetting conditions in the shank. No time is wasted in starting the heater, which is designed to produce 5 lb. (2 kg.) of heated rivets each kilowatt-hour. The new electric heater, which is portable, takes any rivet up to ⅞ in. by 5 in. (2.2 cm. by 12.7 cm.) without adjustment and requires but two power lines.

In constructing the heater a 15-kw. transformer is mounted on angle iron legs, which may be fitted with wheels. At the front of the transformer two copper bars are fitted with heavy air-cooled electrode blocks of cast copper, and under these is another copper block which acts as a support and electrical connection for two rivets in series. When the rivets are stood up on the block and the electrodes are allowed to drop on the head of the rivet, the circuit is completed and heating begins. The two electrodes may be raised independently by two foot pedals, gravity being sufficient to lower the electrodes when the foot is removed. A primary tap switch mounted on the back legs of the machine gives all the variation needed for different lengths and diameters of rivets and rate of heating desired.

The sizes of heaters so far developed are a 5-kw. two-jaw type for rivets up to ½ in. (1.2 cm.) and a 15-kw. two-jaw type for rivets up to ⅞-in. diameter. The



ELECTRIC RIVET HEATER

two-jaw heaters are intended for one-gang use; however, it is said that the 15-kw. machine has heated 500 ½-in. by 1½-in. (3 cm.) rivets in one hour, which is ordinarily enough for two gangs of gun riveters.

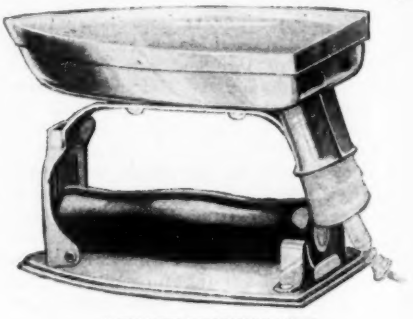
Acid-Type Batteries, Semi-Dry and Liquid

Semi-dry and liquid storage batteries of the pasted-lead-plate type have recently been developed by the Gem Storage Battery Company, 343 South Dearborn Street, Chicago, Ill.

These batteries employ a container of transparent celluloid within which are placed two plates with a corrugated celluloid separator between them, the plates being surrounded by an absorbent material that is not affected by the acid. This material is said to contain no sodium nor does it solidify with age. These batteries are furnished in cells of 2 amp.-hr. capacity. The single units may be used in flashlights or hand lamps, etc. For radio work these cells are assembled in units of ten individual cells, in an outer celluloid container inclosed in an oak case.

Utility Electric Ironing Set

A utility electric ironing set which, because of the small space it occupies, is said to be particularly useful in traveling or on women's dressing tables has been announced by the Edison Electric Appliance Company of 5660 West Taylor Street, Chicago. It consists of a 3-lb.



UTILITY IRONING SET

(1-kg.) electric flatiron, a folding curling iron and a collapsible stand for the iron which can also be used for inverting the flatiron to heat the curling iron or for a small cooking stove.

The flatiron differs from the standard "Hotpoint" iron only in that it has no attached stand and has two holes in the rear for the insertion of curling irons so that the two appliances may be heated at the same time.

The utility set fits into a folding box, approximately 8 in. by 5 in. by 4 in. (20 cm. by 12 cm. by 10 cm.), having four cloth-hinged wooden sides, the feature of which is that when unfolded flat it becomes a handy ironing board with a surface 16 in. by 8 in. (41 cm. by 20.5 cm.).

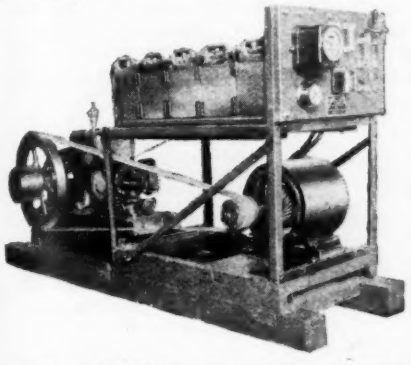
Self-Contained Lighting and Power Plant

A self-contained 32-volt electric lighting and power plant requiring a floor space of but 22 in. (56 cm.) by 76 in. (193 cm.), and known as the "All Purpose" plant, has been brought out by the Automatic Electrical Devices Company, 120 Opera Place, Cincinnati, Ohio. While the plant can be run by any type of engine, it may be obtained from the maker with a 3-hp. "utility" engine which can be quickly taken out of the plant and used for other power purposes.

The new plant starts with a throw of a switch and can be arranged to shut down automatically when the batteries have been charged. A "chargometer" on the switchboard indicates the state of the battery charge. The generator is said to maintain automatically a steady voltage across the lights when the batteries

are charging. The complete plant weighs 750 lb. (340 kg.).

This plant, known as outfit 25B4, has a capacity of twenty-five 20-watt lamps for five hours when using the battery alone or fifty lamps when the engine is running. For places requiring greater capacities than that furnished by the farm size, larger sizes in both 32-volt and 110-



ENGINE DETACHABLE FOR OUTDOOR POWER

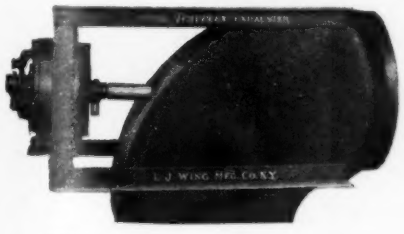
volt styles can be obtained. Also what is termed the "automatic electric unit" can be furnished, consisting of batteries, generator and switchboard mounted on a steel and wooden frame but without an engine.

Exhauster No. 1 with Isolated Motor

The L. J. Wing Manufacturing Company, 352 West Thirteenth Street, New York City, has recently placed upon the market its "Scruplex" exhauster, in which the electric motor is entirely outside of the current of air or vapor being handled by the fan, where it can conveniently be given attention.

The exhauster is said to resemble the ordinary motor-driven ventilating fan made by this company in that it delivers the air straight forward and at practically uniform velocity over its entire area. The fans of these outfits are designed for quiet, high-speed operation, so that small, light-weight, high-speed motors may be employed.

These exhausters are supplied with an air inlet at the top, bottom or either side, or with two inlets, one at one side and the other on the opposite side or one at the top and the other at the bottom, and



INJURIOUS AIR OR VAPOR CANNOT AFFECT MOTOR

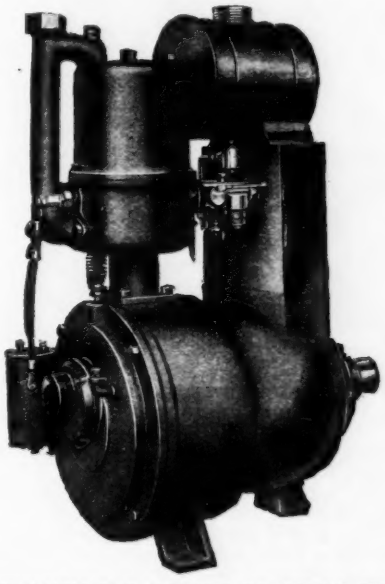
in either of these forms they blow the air directly upward or downward, making a flexible unit that can be easily installed without unsightly or impracticable duct arrangements. The units are made in all sizes from 10 in. (25 cm.) to 48 in. (122 cm.) in diameter.

Compact, Directly Connected Farm-Lighting Plant

A compact 32-volt farm-lighting plant with a capacity of 650 watts has been developed by the Schroeder Headlight & Generator Company of Evansville, Ind., and will be marketed under the name of the Hercules-Sunbeam. The generating unit of the new plant weighs 250 lb. (113 kg.) and is 14 in. (35.5 cm.) wide, 18 in. (45.7 cm.) long and 28 in. (71 cm.) high.

The parts composing the plant are a standard 75-amp.-hr. storage battery and the generating unit, which consists of a one-cylinder, four-cycle gasoline engine operating on the same shaft with the armature of a four-pole, 500-watt direct-current generator, a box containing the electrical control and a gasoline tank.

The line is always kept alive by the storage battery, and when demands exceed 150 watts the plant is automatically placed in operation and supplies the demand on the line as well as recharging the storage battery. When the demand



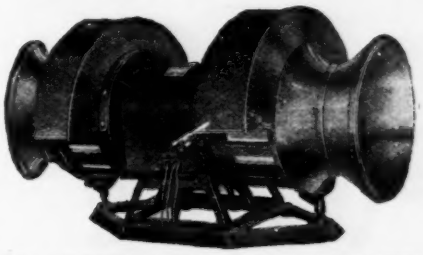
AUTOMATICALLY OPERATED TO SUPPLY CURRENT DEMANDS

for energy ceases the generating unit automatically stops. A hand-operated switch is mounted on the control box for starting the plant without turning on lights or power devices, so that the unit may be started electrically to use the pulley provided on the generator for power or simply to recharge the storage battery. Constant voltage is maintained by an electromagnetic governor.

Double-Head Fire-Alarm Siren

While the Inter-State Machine Products Company of Rochester, N. Y., developed its model M double-head motor-driven alarm siren primarily as a fire signal for volunteer fire departments, the manufacturer states that it can be used in mines and factories, by railroads and large industrial plants as a signal.

A 3-hp. electric motor operates the new siren and is protected by a weatherproof housing of sheet steel. The two sirens are covered for half their circumference with sheet-steel sound intensifiers which are said to aid also in keeping out snow and rain. The aluminum rotors or fans revolve within the iron housing and cut off the air at the openings or parts to



END BEARINGS SUPPORT MOTOR SHAFT, PREVENTING FANS FROM SCRAPING

produce the siren note. The motor shaft alone is not depended upon to carry the load of the fans, but a large end bearing is provided in the housing to support the end of the motor shaft. It is said by the maker that the notes of the siren can be heard for one to two miles under average weather conditions.

Electrically Driven Deep-Well Pump

To supply water under a maximum pressure of 50 lb. from a well between 22 ft. and 50 ft. (6.7 m. and 15 m.) deep the Vaile-Kimes Company, 35 St. Clair Street, Dayton, Ohio, has recently placed on the market its No. 269 electric pumping system for average-sized residenecs. It is said to be especially adapted for farm-lighting systems and is automatic when driven by a 32-volt lighting plant.

MOTOR RUNS ON CURRENT FROM 32-VOLT LIGHTING PLANT

The motor of the new system is of special design, to operate from the 32-volt direct-current system, although a motor operatitng on a higher voltage can be used. A tank of 120, 220 or 315 gal. (454, 832 or 1,192 l.) capacity can be used with the unit.

Lamp Socket Battery Charger for Garages

Storage-battery chargers that may be hung on the wall or carried to an automobile and connected to a convenient lamp extension so that the battery need not be disconnected have been placed on the market by the St. Louis Electrical

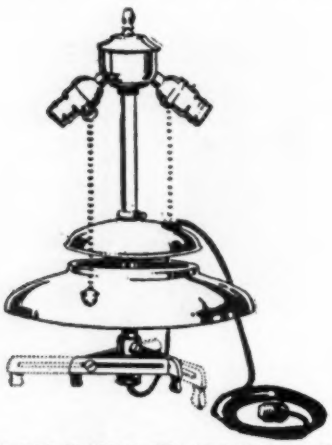
CONVENIENT TO HANDLE

Works, 4060 Forest Park Boulevard, St. Louis, Mo. They are known as type MU and can be furnished to charge one 6-volt battery at a 6-amp. rate and also to charge a 12-volt-battery at a 3-amp. rate. They may be obtained for operation on the regular alternating-current lighting circuit of 110 volts or 220 volts, 60 cycles, and also for 50, 40, 30 or 25-cycle current.

All parts of the new rectifiers are completely inclosed and built to Underwriters' specifications. The meter used is an improvement over that employed in the type M charger made by this company.

Lighting Fixture for Vases

A vase can be converted into a lamp by means of the Vaze-Lite, a lighting fixture which has just been brought out by the Display Stage Lighting Company, 314



DOES NOT REQUIRE THE DRILLING OF HOLES

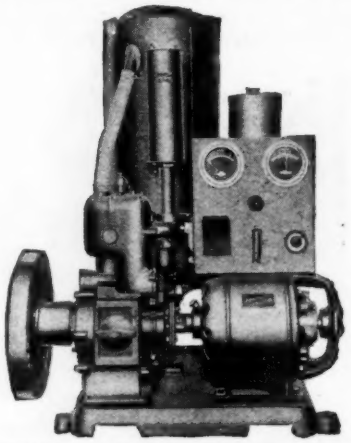
West Forty-fourth Street, New York City.

This device has a canopied triangular body with three adjustable rubber-covered clamps which are designed to grip securely either the outside or inside edge of the vase. The standard of the fixture, at the top of which are two pull-chain sockets, can be raised or lowered to suit the required size of lamp shade. A plug and 9 ft. (2.7 m.) of silk cord are supplied with the fixture, which is made of solid brass finished in brushed brass or stationary bronze.

As an advantage of the new device it is pointed out not only that the drilling of holes in a vase is unnecessary but that the fixture can be easily and quickly changed from one vase to another, thus lending variety to a room's decoration.

Direct-Connected Lighting Plant

For use in places isolated from the usual electrical supply sources the Julius Andrae & Sons Company, 358 Broadway, Milwaukee, Wis., is marketing the "Jasco" direct-connected electric lighting plant. One feature of the new plant is that at the same time the engine is running the generator to charge batteries and furnish energy for lights and motors it gives belt



SUPPLIES BELT POWER WHILE CHARGING BATTERIES

power to overhead shafting or direct to power machinery.

The engine is a single-cylinder vertical type operating on gasoline and rated at 3½ hp. and is connected by flexible coupling to a four-pole direct-current shunt-wound 1½-kw., 40-volt generator with laminated pieces and a commutator 4¾ in. (12 cm.) in diameter. Gould storage battery cells of the sealed-in glass-jar type with 107-amp.-hr. capacity are used.

The switchboard of the new plant carries a field rheostat, a single-pole, double-throw switch on the ignition circuit, a voltmeter and ammeter, and an automatic cut-out, which has a starting button and a manually operated stopping button on its face.

Oil Switches and Circuit Breakers

The maximum ampere capacity of the type E-4 oil switches and circuit breakers made by the Condit Electrical Manufacturing Company of South Boston, Mass., has been increased from 500 to 800. Changes in the frame and on the current-carrying parts have been made to take care of the increased current. These oil switches and circuit breakers are designed for controlling and protecting feeder circuits, generators and transformer banks. They are said to be especially useful in industrial service for the control and protection of large synchronous and induction motors.

Metal Reflectors with Glass Tops

In order to secure better diffusion and fewer sharp light contrasts in industrial plants, the Ivanhoe-Regent Works of the General Electric Company, Cleveland,

LIGHT FROM GLASS TOP BREAKS UP CEILING DARKNESS

Ohio, announce new dome and bowl type metal reflectors with glass tops, permiting a small portion of the light to pass upward to the ceiling to relieve the sharp contrast between the units and the region mmediately above them.

The metal part is one compact piece, the form and the heel being connected by legs welded to each part. The contour of the dome type's metal part is designed to approximate that of R. L. M. standard reflectors of the same size. The small section of opal glass is fitted in the top of the reflector.

Suction Cleaner with Motor-Driven Brush

A vacuum sweeper with motor-driven brush has just been placed on the market by the Hamilton-Beach Manufacturing

SUCTION AND MOTOR-DRIVEN BRUSH USED

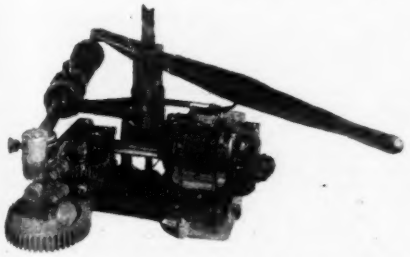
Company of Racine, Wis. The brush is of soft hair and of the vibrating type and has a guard to prevent the fringes of rugs from being drawn up. A Hamilton-Beach air-cooled universal motor is used.

Aluminum is employed throughout in the construction of the sweeper, which is of medium weight. It is built low in order to facilitate cleaning under beds, etc. A non-choking dust bag is used.

Control Mechanism for Pole-Top Switches

A control mechanism for pole-top switches, actuated by a ½-hp. motor, is now being marketed by the Pacific Electric Manufacturing Company, 827 Folsom Street, San Francisco, Cal.

It can be operated at the switch by the hand lever, and should the switch be left



HAS A SPRING-OPERATED QUICK BREAK

in one position while the control is in the other, the hand control is automatically caused to drop into engagement by the operation of the motor control. The new mechanism is designed to pull the switch closed even if stopped and started with the blade entering the contacts. It does not depend on momentum. The new control has a spring-operated quick break.

Device for Tying Insulators on Live Line

For tying new insulators on a live line after the old ones have been removed the Bush Electric Company, 6654 Broadway, Cleveland, Ohio, has developed an attachment to be used on its machine for safely tapping a branch line to a live main line. This tapping machine was described in the ELECTRICAL WORLD of Oct. 13, 1917.

To use the new attachment the tie wire is attached to the insulator with its two tie ends left sticking up so that they will be on appropriate sides of the live wire when it is lowered down on top of the new insulator. The tapping machine with the attachment is then slipped over the main line wire on one side of the

ATTACHMENT ON TAPPING MACHINE "PIGTAILING" TIE WIRE END

insulator. Then the loose end of the tie wire is automatically picked up by the attachment and closely "pigtailed" out along the main line wire in the same manner that it would be done by hand were the line men working on a "dead" line. This operation is then repeated on the tie end on the other side of the insulator.

It is claimed that even a new wiring shield can be wrapped on a line with this attachment. Complete insulator changing equipment is supplied either for pin, suspension or dead-end type insulators.

Direct-Current Interpole Motor for Elevator

For the heavy duties that elevator service imposes the Warner Elevator Manufacturing Company of Cincinnati, Ohio, has developed a direct-current interpole motor with a three-to-one speed variation by field control. To save current there are no by-pass resistances around the armature.

The new motor will start the elevator with one-half of full load current, while the maximum current with average loads seldom exceeds 75 amp.

The acceleration is designed to be

DIRECT-CURRENT INTERPOLE MOTOR

smooth but rapid. Heavy loads, it is claimed, can be lifted on the slow speed of the motor without the use of additional gearing, counterweights or special brakes. The speed variation from no load to full load in either direction is designed to be practically negligible.

The armature of the new motor can be removed without disturbing the motor frame, thus eliminating the necessity for realigning after repairs are made. The field poles or coils can be removed without removing the armature.

Portable Single-Pivot Thermal Meters

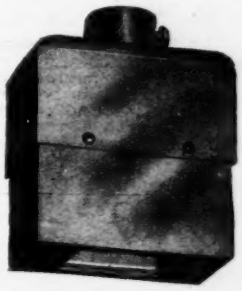
Because the unusual sensitivity of the single-pivot meters made by the Rawson Instrument Company, Cambridge, Mass., renders them particularly useful for thermo-junctions, this company has developed type 501 portable single-pivot thermal meters whose construction is similar to the single-pivot direct-current meters described on page 786 of the ELECTRICAL WORLD for Oct. 4, 1919.

Washer and Wringer for Stationary Tubs

An improved electric clothes-washing machine and wringer which fits into a stationary washtub is being marketed by the Home Devices Corporation, 11 East Forty-second Street, New York City A ⅛-hp. motor is used.

Receptacles and Plugs for Suspension Mounting

For use in shops, warehouses and other locations where posts or other similar places for mounting are not available the Central Electric Company, 316 South Wells Street, Chicago, has developed its No. 1 S. T. and 13 S. T. receptacles and plugs, which can be suspended from



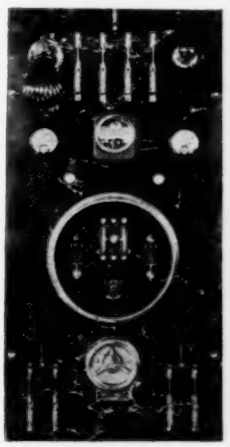
CAN BE SUSPENDED IN THREE WAYS

girders, sills or ceilings at any height from the floor. Three ways of suspension can be used: with ¾-in. (19-mm.) conduit, with ½-in. (12.7-mm.) flexible-hose armor through the use of this company's R 36 fitting, or with ¾-in. (19-mm.) flexible-hose armor by using its type R 32 fitting.

Battery-Charging Voltage Regulator

A device for automatically starting and stopping a motor-generator used in charging storage batteries and for other low-voltage work has been brought out by the U. S. E. M. Company, 301 West Thirty-seventh Street, New York City, and is known as a motor-generator "potentiostat."

It can be used for illumination and emergency lighting and is equipped with



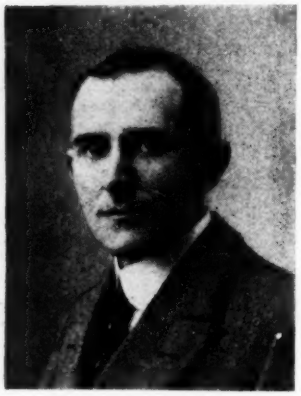
AUTOMATICALLY STARTS AND STOPS MOTOR GENERATOR

an arrangement which automatically operates the emergency lamps, when the primary current fails, and cuts them off when it is resumed. The new device operates on either direct current or alternating current.

Manufacturers' Activities

THE ELECTRIC AGENCIES COMPANY, Pacific Coast manufacturers' representative, has been succeeded by the Allied Industries, Inc., 283 Minna Street, San Francisco, Cal.

H. W. ROSS has recently been elected vice-president of Templeton, Kenly & Company, Ltd., Chicago, manufacturers of Simplex jacks. Mr. Ross has only just returned from France and Spain, where he had served for two years as captain and major in an engineering and purchas-



H. W. ROSS

ing capacity in connection with the Motor Transport Corps. In his new capacity Mr. Ross is acting as general sales manager in the sale of Simplex jacks, giving particular attention to pole pulling, pole straightening and special emergency jacks.

THE SUMTER ELECTRICAL WORKS, Columbia, S. C., expected to close their doors on Nov. 1. This concern is a branch of the magneto factory in Newark, N. J., both of which are owned by the Splitdorf interests.

THE DICKEY STEEL COMPANY, INC., 233 Broadway, New York City, announces its appointment as Eastern sales and export representative of the Hammond Steel Company, Inc., Syracuse, N. Y., manufacturers of high-speed, alloy and straight-carbon tool steels, and a complete line of alloy steels in bars, weldless rings, die blocks and special shapes.

CHESTER A. GAUSS, until recently advertising manager of the Crocker-Wheeler Company, Ampere, N. J., has resigned his position with the company to become a partner in the newly formed firm of Robertson, Gauss & Company, engineering sales and advertising counselors, with temporary offices at 59-61 Pearl Street, New York. Mr. Gauss is a graduate electrical engineer with over seven years' experience in electrical advertising, sales investigation and promotion work and trade-paper editing. Mr. Robertson has specialized for over eighteen years in the illustrating of mechanical products and in the printing of engineering literature. The newly formed firm will specialize in engineering advertising accounts of all descriptions and formulate engineering sales promotion plans for its clients.

THE SANFORD RILEY STOKER COMPANY, Worcester, Mass., announces the appointment of M. G. Brennan as district engineer in the Western territory and W. Mather as district manager in the East.

GEORGE DRAKE SMITH has resigned as manager of the commercial vehicle department of the Edison Storage Battery Company of Orange, N. J., to become assistant to the president of the Winther Motor Truck Company of Kenosha, Wis.

THE ROLLER-SMITH COMPANY, 233 Broadway, New York City, announces the appointment of the Alfred Collyer Company, 83 Craig Street West, Montreal, as its agent for the entire Dominion of Canada and Newfoundland. The Alfred Collyer Company, which also represents the Wagner Electric Manufacturing Company, has a branch office at 183 George Street, Toronto.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, 2032 Washington Avenue, St. Louis, Mo., announces that all Emerson apparatus requiring factory repairs should be consigned to that address. The company has no facilities for making repairs at New York City or other points than St. Louis and is not prepared to make repairs to apparatus of other manufacturers.

THE S.O.S. ELECTRIC SALES COMPANY has just been formed by Howard R. Sharkey, James B. Olson and Howard R. Stivers, with offices at 2 Columbus Circle, New York City. The company will act as manufacturers' agents. Messrs. Sharkey and Stivers were formerly for a number of years agents for the Crescent Insulated Wire & Cable Company, Trenton, N. J, for the Eastern territory, and Mr. Olson was formerly general sales manager of the Habirshaw Electric Cable Company and later associated with the Okonite Company.

COMMANDER FREDERICK G. SIMPSON has again taken up his work as vice-president and general manager of the Kilbourne & Clark Manufacturing Company, Seattle, Wash., manufacturer of radio equipment. Early in the war Mr. Simpson volunteered and was commissioned lieutenant commander at the Boston Navy Yard. It was not long before he was promoted and made district radio officer with rank of commander. Later he was placed in charge of all radio material activity on the Atlantic Coast from Connecticut to Nova Scotia.

THE MECHANICAL APPLIANCE COMPANY, maker of Watson electric motors, with factory and main offices at Milwaukee, Wis., has recently opened new offices in Buffalo and St. Louis. W. C. Winterroth, formerly connected with the Chicago office, will be at 318 Prudential Building, Buffalo, as district sales manager for western New York. The St. Louis office will be in charge of L. F. Mahler, who has been recently appointed district sales agent for St. Louis and adjacent territory. His office is at 1039 Syndicate Trust Building.

THE BLACK & DECKER MANUFACTURING COMPANY announces the removal of its general offices from 105 South Calvert Street, Baltimore, Md., to Towson Heights, Baltimore. At this place ground has been broken and work started on a new and larger plant for the company. The new building will be 100 ft. by 200 ft. and connected to the old manufacturing plant, and will add a manufacturing floor space of 20,000 sq. ft., giving a total of 32,000 sq. ft. Additional machine-tool equipment will be installed to give the plant more than twice its present productive capacity. It is expected that the new plant will be in operation shortly after the first of the year. The company believes that its 1920 output will more than double that of 1919.

H. H. WHITE, sales engineer for James Leffel & Company, with headquarters at Atlanta, Ga., reports an increasing activity in the development of small Southern water powers. Since Jan. 1 of this year his company has installed waterwheels in ninety-eight plants in North Carolina, South Carolina, Georgia, Alabama and Tennessee. These waterwheels range from 20 hp. to 3500 hp., the average size being around 200 hp. to 500 hp. About 45 per cent of the installations were for grist, flour and saw mills, and only 10 per cent of the wheels installed were replacements.

THE INDEPENDENT LAMP & WIRE COMPANY, New York City, which since its beginning seven years ago has been affiliated with the General Motors Company through stock ownership, has taken over the lamp contracts for all of the plants of the General Motors, including subsidiaries. This has not been possible before because the lamp-production facilities were not large enough. Recently, however, the plant was enlarged, and the Independent company is now in a position to turn out more than 30,000 lamps a day. This includes all types except miniatures and automobile lamps. Inasmuch as automobile manufacturers buy the reflectors for new cars all equipped with lamps, the above arrangement does not disturb any current automobile lamp contracts.

THE ZOBELL ELECTRIC MOTOR CORPORATION, which was incorporated last April and capitalized at $250,000, is now located at Garwood, N. J., where it purposes to manufacture both alternating-current and direct-current motors having somewhat similar characteristics and established sizes ranging from 1 hp. to 7½ hp. The company states that it proposes to incorporate in its design of small motors all the requirements found in larger motors. The company is bringing out a line of standard commercial motors, but at the present time it is especially interested in orders for special-purpose motors. The present equipment is designed for an output of from 200 to 300 motors per month. Fred G. Bell is president, A. T. Zoebisch treasurer and F. E. Bucker secretary and superintendent of the plant.

PROMISING FIELD FOR AMERICAN ELECTRICAL GOODS.—A most promising future for American electrical goods exists in Argentina, Brazil and Uruguay, according to a report just made to the Bureau of Foreign and Domestic Commerce, Department of Commerce, by Trade Commissioner Philip S. Smith. The use of electricity is widespread in all three countries. In Argentina and Uruguay the high cost of imported fuel and the lack of water power limit the use of electricity to some extent, but in Brazil the immense amount of water power available makes the electrical field a peculiarly attractive one to manufacturers of electrical equipment. As this water power is found for the most part in the coastal section of the country, it will be available for industrial enterprises and for general lighting, heating and power purposes in the numerous cities of this section, which includes the greater part of the population of the country. American materials were not a very important factor in Argentina before the war, but have become decidedly so since hostilities began, the report says. The problem there is to maintain this advantage when the old competition returns. In Brazil American electrical supplies have always been favored above all others, owing principally to the fact that power plants in the large cities use American materials almost exclusively. Germany's share in the trade, however, was increasing steadily up to the time the war started, and since that time Japanese materials have appeared on the market, although not in large quantities. The trade commissioner's report is a detailed guide published for the benefit of the American manufacturer who wants to make the most of his opportunities in Latin America. It is entitled "Electrical Goods in Argentina, Uruguay and Brazil," Special Agents Series No. 184, and is sold at the nominal price of 20 cents a copy by the superintendent of documents, Government Printing Office, Washington, D. C., and by all district and co-operative offices of the Bureau of Foreign and Domestic Commerce.

Supply Jobbers' Notes

H. C. BABCOCK, formerly manager of the municipal electric lighting plant at Norwood, Mass., has joined the organization of the Stuart-Howland Company, Boston, electrical supply jobber, as sales engineer.

THE ELECTRIC APPLIANCE COMPANY, Chicago, tendered a reception and dance on Sept. 26 to the returning service men of the company. Several hundred were present in honor of the forty men who had been in service.

THE MONTANA ELECTRIC COMPANY and the Washington Electric Supply Company held a semi-annual sales conference at Hayden Lake, Idaho, on Sept. 15-19. There were fourteen representatives of the two associated companies present, besides representatives of eighteen electrical manufacturing companies.

THE PIEDMONT ELECTRIC COMPANY, Asheville, N. C., announces its seventeenth anniversary in the electrical business. The company opened in October 1902 for a contracting business and with a small retail trade and later put its whole thought and attention on the selling of electrical supplies and appliances.

THE GEORGE H. WAHN COMPANY, Boston, Mass., has just issued for distribution in New England only, its sales being almost entirely confined to that section, a thousand-page general electrical supply catalog, showing a complete line of wiring devices, apparatus, etc. This is a big step in the progress of this company.

THE WESTERN ELECTRIC COMPANY has recently added a lighting department to its general sales organization for the purpose of fostering the propaganda for better lighting in factories, offices, hotels, clubs and residences. This new department has been placed under the direction of E. Cantelo White, whose experience in the electric lighting field covers a period of almost fifteen years, during which time his activities as a salesman and designer of lighting equipment have covered both the United States and Canada. Mr. White is also well known to the electrical industry as the originator and designer of the "Duplexalite" line of lighting fixtures. In this connection Mr. White has done a great deal of standardization work, and it will be his aim to carry on this standardization of lighting fixtures to such a degree that planning efficient lighting installations and merchandising the equipments will be greatly simplified.

E. CANTELO WHITE

W. T. HAYES, sales manager of the Mahan Company, will shortly sever his connection with the above company and join the F. Bissell Company, Toledo, Ohio.

THE MOOCK ELECTRIC SUPPLY COMPANY, Canton, Ohio, announces that the foregoing is the corporate name to which the Canton Engineering & Electric Company has been changed. Capital stock has been increased from $150,000 to $500,000, and a branch jobbing house has been established in Youngstown, Ohio. Otherwise there has been no change in personnel of the company.

THE MILNER-FLOWER ELECTRIC COMPANY, Buffalo, N. Y., which is a new organization for the wholesale distribution of electric household appliances, has recently made a statement of its service policy. The company states that it has perfected a financing plan whereby the dealer can offer appliances on long-time payments without tying up his working capital. The company is also starting a training school open to the salesmen of its dealers without charge. The school is held on the fourth floor of the company's building at 256 Main Street, and the time to complete the course is only a few days. In addition to an advertising program, the company has formulated a dealers' sales plan and simplified accounting system. This includes a perpetual inventory of appliances on trial and in stock, survey and prospect cards, follow-up files and assignment slips, advertising records, etc. The company not only furnishes the system but supplies all the files, cards and equipment needed to install it entirely without cost to the dealers. The company has a policy of wholesaling only and announces that it has made arrangements with the manufacturers for the distribution in New York State of the following household appliances: The Eden electric clothes washer, the Simplex ironing machine, the Estate electric range, the Estate Sunburst heater and the Torrington electric sweeper. The company states that from time to time new items will be added to this list. The company will cover New York State west of the Hudson River, employing six salesmen. It will distribute the Eden electric washing and wringing machine, Simplex ironing machine, Estate ranges and other household appliances. George S. Milner of Cleveland is president of the company, and R. E. Flower, formerly of the Erner Electric Company, Cleveland, is secretary, treasurer and general manager.

Trade Publications

TRANSFORMERS. — Bulletin No. 119 from the Wagner Electric Manufacturing Company, St. Louis, Mo., has for its subject distribution-type transformers.

TRANSFORMERS.—Type RO constant-current transformer is covered in bulletin No. 65,110, issued by the General Electric Company of Schenectady, New York.

TESTING.—The Wagner Electric Manufacturing Company of St. Louis, Mo., has issued Bulletin No. 120, a twenty-page publication entitled the "Manual of Electrical Testing."

WASHING MACHINE.—The Harmony electrically operated clothes washer is the subject of a bulletin which has been issued by the Clark-Cadle-Harmon Corporation of Rochester, N. Y.

STARTERS.—The General Electric Company of Schenectady, N. Y., is circulating bulletin No. 68,420, superseding Nos. 68,402-2 and 68,405. It illustrates and describes CR 4015 inclosed automatic starters for small direct-current motors.

FLOOR SCRUBBING AND POLISHING MACHINE.—The John Herr Manufacuring Company, 44 North Fourth Street, Philadelphia, has issued a folder telling about its E-Z automatic electric floor scrubbing and polishing machines.

MOTORS.—The Electro Dynamic Company of Bayonne, N. J., is circulating bulletin No. 100, covering its type "S" interpole direct-current motor.

MOTORS.—Inclosed type "S" interpole motors are covered in bulletin No. 42 which the Electric Dynamic Company, Bayonne, N. J., is distributing.

MOTORS.—Type "S" interpole motors for driving printing presses are dealt with by the Electro Dynamic Company of Bayonne, N. J., in its recently issued bulletin No. 43.

FIBER.—The character, uses and possibilities of its hard fiber are dealt with by the C. H. Whall Company of 170 Summer Street, Boston, in a booklet of recent issuance.

MOTORS.—Applying interpole direct-current motors to the operation of machine tools is the subject of bulletin No. 101 from the Electro Dynamic Company of Bayonne, N. J.

MOTORS.—Bulletin No. 46, which supersedes bulletin No. 45, has been issued by the Electro-Dynamic Company to give ratings and dimensions of its interpole constant and adjustable speed motors, type "S."

STORAGE-BATTERY FILLER. — The General Scientific Equipment Company, North Philadelphia, Pa., is distributing an illustrated folder telling about its Genco distilled water bottle and storage-battery filler.

SEWING-MACHINE MOTORS. — The Wilcox & Gibbs Sewing Machine Company, 658 Broadway, New York City, has issued an illustrated folder telling about an electric motor which can be utilized to operate its sewing machine and which is made by the Westinghouse Electric & Manufacturing Company.

SIGNAL TEST INSTRUMENTS.—The Roller-Smith Company, 233 Broadway, New York City, is circulating bulletin No. 100, covering its "S. S." types electrical instruments for signal system testing. Direct-current and alternating-current portable ammeters and direct-reading portable ohmmeters are shown and spoken of in this bulletin.

New Incorporations

THE COON VALLEY (Wis.) ELECTRIC COMPANY has been incorporated with a capital stock of $10,000 by Anton Oium, Theodore Bekkum and others.

THE PARSONS (Tenn.) LIGHT COMPANY has been incorporated with a capital stock of $5,000 by T. P. Bateman, J. D. Poster, W. M. Neely, J. T. Houston and W. A. Partin.

THE AMENIA (N. Y.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $25,000 by Edward P. Chaffee, Lewis F. Eaton and Edward B. Thompson of Amenia.

THE HAMDEN (N. Y.) ELECTRIC LIGHT COMPANY has been chartered with a capital stock of $3,000 by H. Greeley Howland, John Chambers and James E. Colgan of Hamden, N. Y.

THE CUTLER (Ind.) IMPROVEMENT COMPANY has been incorporated by William H. Draper, John F. Jervis and Edgar Glenn. The company is capitalized at $12,000 and proposes to generate and distribute electricity for lamps and motors.

THE LEOPOLIS (Wis.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by Rudolph Kucksdorf, James Cerveny and Joseph Boehn. The company is capitalized at $5,000 and proposes to generate and distribute electricity for lamps, heaters and motors, etc.

THE EAU GALLIE (Fla.) ELECTRIC COMPANY has been incorporated with a capital stock of $50,000 to construct and operate electric light, gas and ice plant, etc. The officers are: W. H. H. Gleason, president; A. R. Hodgson, vice-president, and J. M. Law, secretary and treasurer.

Record of Electrical Patents

Notes on United States Patents

(Issued Sept. 16, 1919)

1,316,486. Direction Indicator; Nathaniel W. Kleinman, Brooklyn, N. Y. App. filed Jan. 18, 1916. Also Illuminates license plate.

1,316,490. Storage - Battery Construction; Warren P. Loudon, Niagara Falls, N. Y. App. filed Feb. 13, 1918. Prevents the escape of electrolyte along the electrical conductors.

1,316,516. Warning Signal for Grade Intersections of Railways and Highways; Clarence S. Snavely, Pittsburgh, Pa. App. filed April 24, 1915. Swinging-arm type.

1,316,540. Telegraphy and Apparatus Therefor; Algernon C. Fuller, Woburn, Eng. App. filed Sept. 22, 1917. Telephone and telegraph over same wire.

1,316,546. Combined Transformer and Rectifier; Erwin B. Stack, Monroe, N. C. App. filed July 22, 1918. Portable and adaptable to automobiles.

(Issued Sept. 23, 1919)

1,316,552. Phonograph-Motor Control; Vincent G. Apple, Dayton, Ohio. App. filed Sept. 22, 1917. Operating circuit closers in predetermined sequence to avoid arcing.

1,316,561. Swivel Plug Connector; Edward Dewald, Sr., Cincinnati, Ohio. App. filed April 9, 1919. Prevents twisting of cables of irons, drills, riveters, telephones, etc.

1,316,567. Battery Container; Isidor Fertman, New York, N. Y. App. filed Dec. 19, 1918. Weak cells identified quickly.

1,316,574. Impulse Sender; Edward V. Hartford, Deal, N. J. App. filed Jan. 22, 1914. Automatical make and break adapted to control elevators, cars or vehicles.

1,316,597. Dry Cell; Arlie W. Schorger, Madison, Wis. App. filed Nov. 19, 1918. Change in structural arrangement of cathode.

1,316,603. System of Distribution; William I. Thompson, Newark, N. J. App. filed Dec. 14, 1916. Adapted to lighting circuits.

1,316,617. Automatic-Feed Electric Soldering Iron; David A. James, New York, N. Y. App. filed April 4, 1919. Solder effectually controlled and regulated to meet the requirements.

1,316,658. Graphic Recording Instrument; Otis White and John Kremer, Springfield, Ill. App. filed Oct. 14, 1916. Shows variations of quantity or pressure in electric circuits.

1,316,671. Fuse Plug; Reuben B. Benjamin and Ernst G. K. Anderson, Chicago, Ill. App. filed May 2, 1916. Multiple type.

1,316,672. Lifting Magnet; John P. Bethke, Milwaukee, Wis. App. filed Dec. 4, 1917. For either 110 volts or 220 volts.

1,316,699. Telegraphy; Thomas B. Dixon, New York, N. Y. App. filed Dec. 5, 1913. Increases the efficiency of radio-electric relays by use of selenium cells.

1,316,700. Electric Lighting Fixture; Garry J. Dormandy, Troy, N. Y. App. filed May 10, 1917. Movable and adjustable pedestal fixture.

1,316,704. Measured-Service Telephone System; John Erickson, Chicago, Ill. App. filed Dec. 24, 1917. Meter control circuits in automatic systems.

1,316,711. Lamp-Clamping Attachment for Lamp Sockets; Bertram J. Grigsby, Peoria, Ill. App. filed Jan. 8, 1917. Projecting flat spring steel to prevent lamp from unscrewing because of vibration.

1,316,730. Internal-Combustion Engine; Wilwiam A. Loudon, Chicago, Ill. App. filed Feb. 28, 1916. Cuts out cylinders on light load.

1,316,760. Electric Battery; Raymond C. Benner and Harry F. French, Fremont, Ohio. App. filed Oct. 5, 1916. Uses copper oxide and sulphides.

1,316,761. Electric Battery; Raymond C. Benner and Harry F. French, Fremont, Ohio App. filed March 30, 1918. Process for making depolarizers.

1,316,765. Carbon Element and Method of Making the Same; Thomas W. Byrne, Boston, Mass. App. filed Nov. 2, 1018. Capable of withstanding heavy shocks and jars.

1,316,769. Apparatus for Treating Ores; Carl Cornwell, Berkeley, Cal. App. filed June 30, 1915. Screw conveyors utilized.

1,316,790. Arrangement for Cooling High-Speed Dynamo-Electric Machines; Max Gruber, Geneva, Switzerland. App. filed May 26, 1919. Ejector action draws cooling air through air gap.

1,316,798. Dynamo-Electric Machine; Benjamin G. Lamme, Pittsburgh, Pa. App. filed May 2, 1917. Damping windings to be used in connection with the rotors of high-capacity, single-phase turbo-generators that carry unbalanced electrical loads.

1,316,836. Battery; Frank Garaca, Cleveland, Ohio. App. filed June 18, 1918. Light weight.

1,316,874. Electric Vibrator; Edward J. Bodey, Cincinnai, Ohio. App. filed Nov. 18, 1916. Eccentrically weighted rotating member.

1,316,892. Two-Way Circuit; John E. Hilbish, La Grange, Ill. App. filed July 16, 1915. Complete connection between subscribers in the same exchange and between subscribers in different exchanges.

1,316,900. Electric Switch; Charles J. Klein, Milwaukee, Wis. App. filed March 13, 1914. Receptacle having push-buttons.

1,316,901. Overload Air-Break Switch; Carl G. Koppitz, Greensburg, Pa. App. filed June 22, 1917. Automatic trip mechanism on the top of an insulator which rotates to transmit power to operate directly or indirectly a main switch.

1,316,916. Spark Gap; William Meyer, Chicago, Ill. App. filed Sept. 11, 1917. A series of parallel spark gaps of same lengths in multiple.

1,316,955. Contactor; Leonard P. Hutt, Schenectady, N. Y. App. filed March 21, 1918. Electromagnetic switches for automatic starting of the motor.

1,316,967. Gaseous Conduction Lamp; Daniel McF. Moore, East Orange, N. J. App. filed Nov. 30, 1917. Lamp with stationary electrodes of same dimensions as an incandescent lamp.

1,316,975. Socket; Frank C. De Reamer, Schenectady, N. Y. App. filed Aug. 19, 1915. Switch mechanism of "pull" type.

1,316,983. Electrical Regulator; Louis W. Thompson, Schenectady, N. Y. App. filed Jan. 4, 1917. Regulates alternating-current generators without limiting.

1,316,995. System of Frequency Transformation; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Dec. 6, 1917. Impresses an alternating current of harmonic frequency upon a radiating system for radio-signaling purposes.

1,316,998. Automobile Machinery; Joseph Bijur, New York, N. Y. App. filed Nov. 19, 1914. Effective connection of generator with an internal-combustion engine.

1,317,002. Electrical Apparatus; Elmer E. F. Creighton, Schenectady, N. Y. App. filed May 8, 1916. Windings protect electrical apparatus against the effects of excessive voltages.

1,317,003. Reactor; Elmer E. F. Creighton, Schenectady, N. Y. App. filed May 29, 1916. Reactor of bare conductors the turns of which are embedded in plastic.

1,317,025. Radiosignaling Installation; Marius C. A. Latour, Paris, France. App. filed Nov. 15, 1917. Distribution of self-induction coils along the antenna wires.

1,317,062. Controlling Device for Elevator Cars and the Like; Edward Wylde and Charles A. Reiners, New York, N. Y. App. filed Sept. 12, 1914. Prevents too great a speed during a part of the travel of the elevator.

1,317,074. Telephone System; Henry P. Clausen, Mount Vernon, N. Y. App. filed Aug. 30, 1916. Employing machine switches.

1,317,076. Relay or Solenoid; Preston W. Cummings, Chicago, Ill. App. filed Feb. 27, 1915. Polarized magnet relays or solenoids used in elevator signal work.

1,317,077. Apparatus for Making Gasoline from Crude Oil; Paul Danckwardt Denver, Col. App. filed Aug. 27, 1917. Combination blast and electric heater.

1,317,082. Radioactive Device; Max Hartenheim, Pittsburgh, Pa. App. filed May 27, 1918. Separators to provide radioactive or ionizing exciters.

1,317,109. Program Device; Alfred L. Sohm, Chicago, Ill. App. filed May 21, 1917. Provides means for selectively actuating signals as desired.

1,317,123. Electric Horn; Gustav Blumberg and John A. Butkus, Baltimore, Md. App. filed Oct. 13, 1915. Quality of the tone changed to suit the user.

1,317,139. Reserve Dry Cell; Alfred Landau, New York, N. Y. App. filed June 18, 1918. Consumer supplies a charge of water to the cell, whereby an electrolyte is formed.

1,317,476. Electrical System; Joseph Bijur, New York, N. Y. App. filed March 9, 1911. Apparatus for regulating voltage.

1,317,492. Electric Incandescent Lamp; Lodewijk Hamburger and Dirk Lely, Jr., Eindhoven, Netherlands. App. filed Jan. 11, 1917. Prevents obscuring of bulb.

1,317,497. Graphitized Electrode and Process of Making the Same; Arthur T. Hinckley, Niagara Falls, N. Y. App. filed March 11, 1919. Larger cross-sectional area utilized.

1,317,498. Carbonaceous Material and Process of Making Same; Arthur T. Hinckley, Niagara Falls, N. Y. App. filed June 24, 1919. Subjects coal in lump form to calcination at high temperatures.

1,317,506. Keyboard Telegraphic Transmitter; Edward E. Kleinschmidt, Brooklyn, N. Y. App. filed Jan. 11, 1915. For use with printing telegraphs.

1,317,548. Electric Connection; Albert Casper, Vallejo, Cal. App. filed April 25, 1918. For plug and socket.

1,317,557. Magnetic Ore Washer; Edward W. Davis, Duluth, Minn. App. filed April 25, 1917. Metal precipitated from tailings.

1,317,576. Electrode; Sigurd Heier, Rjukan, Norway. App. filed July 29, 1916. For electric arc furnaces or large arc lamps.

1,317,659. Pad for Carrying Radioactive Ores and Means for Increasing the Activity of the Ores; Phyllis E. Charles, Victorville, Cal. App. filed June 15, 1918. Electric heating pad.

(Issued Sept. 30, 1919)

1,317,152. Calling Device for Automatic Telephone Systems; John G. Blessing, Chicago, Ill. App. filed Nov. 22, 1916. Combines calling device and desk phone in one instrument.

1,317,155. Ringing Arrangement for Four-Wire Circuits; Charles S. Demarest, Brooklyn, N. Y. App. filed Dec. 2, 1918. Ringing current from one system relayed to another system.

1,317,173. Automobile Signal; Edward F. Marrs, San Diego, Cal. App. filed Nov 24, 1916. Front and rear signals.

1,317,178. Controlling Device for Use on Motor Cars and Elsewhere; Richard H. Rogers and Primus O. Dorter, London, Eng. App. filed April 23, 1918. Combines controlling device and switch handle.

1,317,190. Semi-Automatic Telephone System; George A. Yanochowski, Chicago, Ill. App. filed Nov. 25, 1914. Automatically gives signal to calling subscriber.

1,317,199. Arc-Lamp Electrode; Isador Ladoff and Ralph W. E. Moore, Wilkinsburg, Pa. App. filed June 29, 1914. Has copper arcing end.

1,317,203. Contact Terminal; Tillman D. Lynch, Wilkinsburg, Pa. App. filed Jan. 5, 1915. For knife-blade switches.